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COMMENTARIES

UPON

B O E R H A A V E's

A P H O R I S M S

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

BY

BARON VAN SWIETEN,

Counsellor and First Physician

To their Majesties the Emperor and Empress of Germany;

Perpetual President of the College of Physicians in Vienna;

Member of the Royal Academy of Sciences and Surgery at Paris;

H. Fellow of the Royal College of Physicians at Edinburgh;

&c. &c. &c.

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COMMENTARIES

U P O N

B O E R H A A V E's

A P P H O R I S M S

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

Of a GANGRENE.

§. 419. **I**F a gangrene (388) follows upon an inflammation (371, 372,) the case will require a different method of cure.

By a Gangrene we understand that disposition of a soft part, which from a deficient influx of the vital humour into the arteries, and efflux through the veins, has a tendency to death; and by a Sphacelus we mean that state, wherein all vital action is absolutely destroyed in the part affected, though life still subsist in the other parts.

From what we have said concerning an inflammation, it is plain, that every inflammation is subject to various events; and may either be carried off by discussion, or may terminate in a suppuration, gangrene, or scirrhus. We have already discoursed concerning Discussion, and Suppuration; and it now comes next in order to treat of a Gangrene; and then of a Sphacelus, which frequently follows after it.

Galen has given us a very exact description of a

gangrene in the following words: *Gangranas autem vocant mortificationes ob magnitudinem inflammationis, non quidem factas, sed quæ fiunt*^a; “Mortifications arising from the violence of an inflammation are termed *gangrenes*; not mortifications indeed actually formed, but such as are approaching;” or, (as this passage has been elegantly enough paraphrased), *quum pars corporis aliqua ob inflammationis magnitudinem nondum emortua est, sed adhuc emoritur*; “when any part of the body from the violence of an inflammation is not actually dead, but is as yet in a state of dying.” This definition is, according to his usual custom, transcribed from Galen by Ægineta^b; with this observation premised, That an inflammation, which is neither carried off by discussion, nor brought to a suppuration, for the most part terminates in a gangrene or sphacelus. A gangrene therefore denotes the first approaches of a mortification in any part of the body: And where a gangrene is thoroughly formed, it is easily distinguished from an inflammation by the signs which will be mentioned in §. 427. But where the inflammation is only at the height, and upon the point of being changed into a gangrene, or when the gangrene is beginning to arise from the inflammation, there will in that case arise some ambiguity from this definition. For, in this kind of middle state, the violent inflammation does but approach towards death, and the beginning gangrene has not as yet entirely extinguished the life that was in the part. This Galen has very justly observed in another place. For after having premised, that a gangrene was an intermediate disorder between a sphacelus and a violent inflammation, and that it as much exceeded an inflammation as it fell short of a sphacelus, he adds, *We sometimes misuse the names of like diseases, and apply them to such as bear some resemblance to them indeed, but are not entirely of the same nature and species. Thus we sometimes call a very great inflammation, when it no longer retains its colour, nor is attended with pain, by the name of a gangrene*

^a Method. Medend. ad Glaucon. lib. ii. cap. 11. Charter. Tom. X. p. 388.

^b Lib. iv. cap. 19. p. 64.

grene; though perhaps it may not as yet be strictly a gangrene, but only upon the point of being so in case it be neglected^e.

Celsus seems also to have used both the name of *cancer* and *gangrene* indifferently, to express this disorder. For, says he, *sometimes either from too great an inflammation, or from immoderate heat, or excessive cold, or because a wound is too much closed, or from old age, or a bad habit, a cancer shall ensue*^d. He next gives such a description of a cancer, as suits well both with a gangrene and a sphacelus, (for Celsus absolutely distinguished a cancer from a carcinoma); and then subjoins, *Sometimes that disorder comes on which the Greeks call a gangrene. The former indisposition* [to wit, the cancer] *has its seat in every part of the body: the latter* [the gangrene] *in the parts that are prominent, between the nails, in the arms, or groin; and for the most part in persons of an advanced age, or an ill habit of body*^e. He then proceeds to give an accurate description of the several symptoms which follow upon a spreading gangrene, till at last it terminates in a sphacelus. From whence one might imagine that Celsus gave the name of *gangrene* to the same disorder when seated in the extremities, which he called by the name of *cancer* when found in the other parts of the body. And yet, in the same chapter, describing the cure of a cancer, he says, *Sometimes all applications shall prove fruitless, and the cancer spread notwithstanding our best endeavours; in which case, the only remedy left is the unhappy*

B 2 circum-

^c Abutimur autem interdum vicinorum affectuum nominibus ad eos significandos, qui ad hos quidem accedunt, neque tamen ex toto ipsorum speciem et naturam habent. Sic igitur et maximam inflammationem, quando non amplius suum colorem servat, nec dolorem, interdum gangrænam nominamus, quamvis nondum exacte gangræna sit, futura tamen paulo post si negligatur. *Comment. iv. in Hippocrat. de Artic. Charter. Tom. XII. p. 437.*

^d Interdum vel ex nimia inflammatione, vel ob æstus immodicos, vel ob nimia frigora, vel quia nimis vulnus adstrictum est, vel quia corpus senile, aut mali habitus est, cancer occupat. *Lib. v. cap. 26. n^o 31. p. 300, 301.*

^e Modo oritur ea, quam Græci γαγγραινα appellant. Priora [*cancer* nempe] in qualibet parte corporis fiunt: hæc [*gangrena*] in prominentibus membris, id est, inter ungues et alas, vel inguina; fereque in senibus, vel in his quorum corpus mali habitus est.

circumstance of cutting off the member, which gradually dies, in order to preserve the rest of the body^f. Where we plainly see that he speaks of the extirpation of the extreme parts, when sphacelated; and yet Celsus names this disorder a *cancer*.

A gangrene follows an inflammation, when the obstruction is not only so violent as to be incapable of being dissolved, but is also found in every vessel of the obstructed part: or in case any of these vessels should chance to be free and open in the beginning of the disorder, they are notwithstanding so compressed by the adjacent vessels that are obstructed and swollen, as in a short time to lose the power of transmitting any humour through the arteries, and consequently nothing can return by the veins which communicate with the obstructed arteries. And the case will be the same, if, either through the impetus and velocity of the circulatory motion, or the acrimony of the circulating humours, or from both these causes concurring together, the vessels in the inflamed part be suddenly broken, and the extravasated humours become putrid. (See §. 388.) In both these cases, it is plain, the influx of the arterial liquids into the part will be interrupted, and the return of the same liquids by the veins will be cut off; so that the whole part thus affected will have no longer any vital communication with the rest of the body, and of course, from the spontaneous change which is natural to all animal-substances, will be disposed to putrefy. The method of cure, therefore, must be very different here from what is required in the case of a suppuration; in which there is indeed a gentle separation of the extremities of the obstructed vessels, as also of the obstructing impassable matter, and at the same time some deviation of the liquids from a state of sanity; but yet such a one as nature is able to conquer: whereas putrefaction is a kind of conquest over nature, as Galen has well observed, (see the passages quoted under §. 387.) For where the innate heat, he says, departs very much from

^f Solent vero nonnunquam nihil omnia auxilia proficere, ac nihilominus serpere sub his cancer. Inter quæ miserum, sed unicum, auxilium est, ut cætera pars corporis tuta sit, membrum, quod paulatim emoritur, abscindere. *Ibid.* n. 34. p. 304.

from its proper degree of warmth, there the blood will turn to putrefaction, as in a dead carcase; but when the said heat shall still retain some part of its power, then the change will be of a mixed kind, partly arising from the cause that is preternatural, and partly from the cause which acts according to nature: The preternatural cause disposes to putrefaction, the natural one to concoction. In suppuration, therefore, there is a concoction from the life remaining in the part, which is the cause that acts according to nature: whereas, in a gangrene, putrefaction alone is the agent, and is preternatural.

So long, therefore, as the soft parts only are in this dying state, or are actually dead, the case is called a *gangrene*; which has its seat principally in the *panniculus adiposus*, as we shall shew in the following paragraph: but when the muscles, the tendons, the ligaments, the periosteum, or the bones themselves, are absolutely mortified, then the case is termed a *sphacelus*. But whereas in a dead body every vital action ceases both in the whole and in every part, it is therefore added in the definition, That a *sphacelus* supposes absolute death in the part affected, and life to be still remaining in every part besides. And because in a gangrene there is generally some heat left; arising from the life which still subsists in the parts that lie round it and under it; and as it most frequently follows a violent inflammation, which sets on fire the affected part, (inasmuch that, as we have already observed, a violent inflammation shall be sometimes termed a gangrene, when it borders upon that state); it is usual with the surgeons in Holland to call a gangrene by the name of *heet vuur*, or *hot fire*; and a *sphacelus*, wherein all vital action ceases, by the name of *koud vuur*, or *cold fire*, because the part thus affected is in a short time reduced to the like degree of cold with the ambient air, the cause from whence heat arises, which is the motion of the humours thro' the vessels, being absolutely wanting in a sphacelated part.

However, the word *sphacelus*, in the writings of the ancient physicians, does not seem always to have im-

plied the absolute death of the part affected. Thus, for instance, Hippocrates^s speaks of a sphacelus of the brain itself; but has not absolutely pronounced this disease to be mortal, saying only that it is a case which few get over; and in the next chapter he has pointed out a method of cure for it: whereas it is very plain that if an absolute mortification of so noble a part was to be understood by this appellation, a sphacelus properly so called, in this part, must not only be mortal, but dispatch very suddenly too. So Galen^b, explaining a passage of Archigenes, an old physician, in which the word σφακελωδες occurred, has observed that the meaning of this word is very ambiguous, as some persons have applied this term to any violent pain, others to such an excess of inflammation as was attended with the danger of the parts being putrefied, others to the putrefaction itself, &c. There are several other passages in Hippocrates and Galen, which shew this word to have been used in different senses, as may be seen in Goræus and Fœsius's *Oeconomia Hippocratis*. It is sufficient to our purpose to have produced one or two.

§. 420. **A** Gangrene, therefore, for the most part has its seat in the *panniculus adiposus*; a sphacelus is more universally extensive, and carries the infection to the very bones. The gangrene goes before, and the sphacelus generally follows, unless the disorder first had its rise from a corruption of the bone, marrow, or periosteum. From whence there also proceeds a particular kind of gangrene, arising in the parts that are situated under the medulla spinalis, after a bruise; and unattended either with fever, inflammation, or loss of natural heat.

It has been shewn in the commentaries upon §. 374, that the seat of an inflammation is seldom any where else

^s De Morb. lib. i. cap. 7. Charter. Tom. VII. p. 558.
^{de} Locis Affectis, cap. 8. ibid. p. 409.

^b Lib. ii.

else than in the *panniculus adiposus*; and as a gangrene almost constantly follows a very violent inflammation, it is plain that it must also have the like situation. But here we must observe, that the surgeons are sometimes apt to apprehend there is a sphacelus, when there is only a gangrene. For instance, in a phlegmon upon the back of the hand, where there is scarce any fat to be seen, the cellular membrane shall sometimes swell to an almost incredible degree: if then a gangrene follow upon such a phlegmon, and the thickness of the mortified part be found to be so exceeding great, the whole hand shall in this case be sometimes judged to be sphacelated; and yet, when the corrupted parts shall have been separated and cast off, the tendons and muscles shall be discerned to lie sound and whole under the cellular membrane, which has thus been swelled. And if in so lean a part so large a swelling shall arise from an inflammation, what may not be expected in the buttocks, thighs, legs, arms, &c. where there is naturally observed so large a quantity of fat, lying upon the bigger muscles, in order to lubricate them and facilitate their motions?

Though, therefore, the gangrene shall often be found to sink very deep; yet we learn from daily observations in surgery, that the whole tumour shall not extend beyond the *panniculus adiposus*; and that in this case the mortified part may be separated and carried off in large portions from the sound parts, which lie underneath; by which means the parts of the body shall sometimes be preserved, where nothing but extirpation seemed capable of giving relief. A sphacelus, on the other hand, does not only corrupt the *panniculus adiposus*; but carries absolute destruction along with it into the muscles, tendons, ligaments, periosteum, and bones themselves.

If now we consider, that the *panniculus adiposus*, when distended to this monstrous size, and still farther pent up, as it frequently is, within an unbroken skin, must necessarily compress all the parts which lie underneath it; we shall easily discern, that all the vital influx of the humours into the said parts, and efflux out of them.

them, may be prevented by this single cause. Add to this, that the putrefaction following upon a gangrene may likewise spread the contagion over all the parts that are contiguous, from whence it so frequently happens that a gangrene precedes a sphacelus. And yet there are some cases, where there may be a sphacelus without any preceding gangrene: as for instance, if by a violent bruise received in any part of the body the injury destroys all before it at once quite down to the very bone; or if, by any cause whatsoever, the bones themselves, or the marrow contained within them, or the periosteum which carries the vessels to them and receives such as return from them, be so affected, as to admit of no vital motion of the humours thro' the arteries and veins in these parts. Such a corruption of the bones hath been frequently observed in the venereal disease and *spina ventosa*, though the incumbent parts have not been mortified: and in this case the disorder ascending from below corrupts all the parts that lie above it; whereas, in a gangrene, the incumbent parts are first affected, and the disorder gradually spreads to the parts beneath.

But the reason why a gangrene follows, when by any violent bruise, wound, or other cause, the spinal marrow shall be so injured, as to prevent the liquid of the nerves from flowing into the parts which lie under the place where the injury was received, has already been given in the commentaries upon §. 162. where at the same time it was observed that the like ill effects will follow upon the destruction of the larger nerves. But as other gangrenes do either constantly follow after violent fevers and inflammations, or proceed from the mere deficiency of native heat in extreme old age, this species, which shews itself without any of these preceding circumstances, though it operates slowly indeed, yet carries a sure destruction to all around it.

§. 421. **T**HE cause therefore of a gangrene and of a sphacelus is the same; differing only in violence, duration, and place.

When

When the vessels of our body are so changed, that they can no longer transmit the blood and other liquids which flow through them in a state of health, nor secrete the liquors to be secreted from them, or carry off the remainder into the veins, it is a state of death, which, when it takes place only in the *panniculus adiposus* and *cutis*, is called a *gangrene*, or, if all vital action is absolutely destroyed in any entire part of the body, a *sphacelus*. The cause therefore which produces a gangrene or a sphacelus will be the same, namely, whatever takes away or destroys the influx, efflux, secretion, and excretion, of the humours in any part of the body.

But the efficacy of this cause must be considerably greater, when it produces a sphacelus, than when it occasions a gangrene; as the more solid parts are corrupted by a sphacelus, such as the muscles, the tendons, and even the bones; whereas, in a gangrene, the mischief extends only to the tender *panniculus adiposus*, and often goes no farther than the skin.

And yet the same cause which has produced a gangrene, if it continues to act, may produce a sphacelus. If, for instance, by any external compression the vital influx and efflux of the humours in the skin and *panniculus adiposus* be entirely taken away, it is plain, that, unless the compressing cause is capable of being removed, the parts underneath quite down to the bone must suffer in like manner, and thus a sphacelus be formed by the continued action of the same cause.

But, as we have already observed, the seat of a gangrene is in the *panniculus adiposus*; whereas there is no part exempt from the seizure of a sphacelus: and hence arises another mark of distinction between a gangrene and a sphacelus.

§. 422. **T**HEREFORE, *first*, All the causes producing an inflammation (375, 376, 377, 378, 379), where the liquids stagnate, and the impetus of the blood against them is considerable, have place here: and particularly, 1. The
ligature

ligature of the veins; 2. Their compression from any cause whatsoever, as by a tumour, &c. 3. Intense cold; 4. An obstructed perspiration in a phlegmon by astringent, emplastick, cold, repelling, stupefying applications, especially if any sharp medicines be given internally, or any thing acrimonious be mixed up with what is outwardly applied; 5. An internal or external inflammation; 6. Wounds, bruises, luxations, fractures, especially if the bandages be fastened on too tight; 7. Oily acrid substances applied either to such parts as are sound or diseased; 8. Lying upon the part affected; 9. Ruptures, where the intestines are entangled, and cannot be replaced.

In this and the following paragraphs are assigned the causes which are capable of producing a gangrene and sphacelus. In the first place are recited the severall causes producing an inflammation, and which have been mentioned already under the numbers that are referred to. For every inflammation supposes an obstacle in the minuter arteries, which gives an impediment to the free passage of the liquid that ought to be transmitted through them; and therefore, if this circumstance was to occur in all the vessels distributed through any part of the body, a sphacelus would of necessity arise, as all vital motion of the humours through the part thus affected would by this means be prevented. And if we consider at the same time, that, from the definition of an inflammation given in §. 371. there is not only in this case a stop given to the motion of the liquid which cannot pass, but that also the impetus of the blood pressing from behind on the parts obstructed is very considerable; we shall plainly discern, that a sudden rupture of the smaller vessels must frequently follow, with an effusion of the contained liquids, putrefaction, &c. and consequently a gangrene, as we have shewn in the commentaries upon §. 388. But as the arteries ought to transmit their humours

humours to the veins, whose office it is to carry them back to the heart, from whence they are to be driven again through the arteries in order to form a due circulation of the blood through the whole body and its several parts; therefore all the causes which prevent the arteries from discharging their fluids freely into the veins, may be capable of extinguishing the vital motion of the fluids in the part, and consequently may produce a gangrene and a sphacelus. But we have shewn in the commentaries upon §. 119. that the veins can only be obstructed by an external compression, and therefore under this head we must rank,

1. The ligature of the veins.] The celebrated Author of these Aphorisms used to relate the following case to his auditors upon this occasion. A young gentleman, who was a student in the university of Utrecht, having past his evening jovially amongst his companions, went home to his lodgings pretty well drunk. Wanting air, he threw open his casement, and leaning in the window upon both his elbows, being overpowered with sleep and wine, he continued in this posture all night. The next morning waking, and attempting to move, he fell down, as if he had wanted feet. For, by an unhappy accident, the waistband of his breeches, being very tight, had so compressed the veins, that no part of the blood was capable of returning by them, though at the same time it was forcibly driven through the arteries, the circumstance of his being drunk increasing its impetus: whence there arose a tumour of the parts, and from this tumour a still greater tightness in the waistband of his breeches; by which means the vital motion of the humours being entirely stopped, both legs were seized with a gangrene, which soon after ascending to the thighs proved mortal.

2. Their compression, &c.] As a gangrene may be formed by a ligature, so also for the same reason it may arise from any other cause which compresses the veins. We learn from the writers of observations in physic and chirurgery, that incurable gangrenes and sphaceluses have owed their original to latent tumours in the body, which could not be removed by art, nor with-
out

out difficulty discovered. Thus ^a Hildanus reports a wonderful case of this kind, which fell under his own inspection. A patient of his, in the flower of his age, and of a very good constitution, was seized with a sudden coldness, weight, and numbness, in both his legs, without any preceding cause that he could give an account of: this disorder increasing gradually, was followed with a gangrene, and after that with a sphacelus, which ascending up to his knees ended in his death. Upon opening the body, there was found a scirrhus tumour compressing the *vena cava descendens*, near the place where it is divided into the two iliac veins. This faithful writer adds, that he could have given several other instances of a like nature, which for brevity's sake he omitted. The case of the man I mentioned in the commentaries upon §. 413. which I happened to see myself, was no less wonderful. About a fortnight before he died, his left leg grew painful, swelled, and at last became entirely oedematous, the swelling arising above his knee; and as the extremity of the foot at the same time began to grow cold, and the ends of the toes to look livid, I apprehended that a gangrene was approaching, and for this reason ordered warm antiseptic fomentations to be perpetually applied to the whole part both night and day. The very skilful surgeon, who attended also, was of the same opinion with me, that a latent collection of matter pressed upon the iliac or crural vein; and therefore that no relief could possibly be obtained, unless we could remove the compressing cause. And yet, by all the inquiry we were able to make, it was not in our power to discover the place where the cause of the mischief lay, so that we judged it requisite to proceed in the use of our antiseptics only. The next day we were surprised to find, that the swelling of the leg was considerably abated, and the coldness grown much less, our patient and the persons about him telling us, that he discharged at several times a very large quantity of wind by the anus, and with a prodigious noise. After this no hour passed without a visible diminution of the swelling; in-

much

^a De Gangræna et Sphacelo, cap. 4. p. 775.

much that in two days time, with the use also of gentle friction, it was entirely carried off. In the body, as has been already observed, there was no pus found in the larger cavities: but in the abdomen the *intestinum colon*, instead of passing under the bottom of the stomach as it usually does, lay upon it distended with wind; and that part of it which on the left side runs downward from the spleen and lies behind the small guts, was so contracted, as scarce to equal the thickness of one's thumb; and as soon as it came out from underneath the small guts, it appeared to be again inflated. From whence it seems highly probable, that the colon, which in this place lies upon the iliac vein, and was much distended with wind, pressed upon it, and thereby occasioned the swelling of the leg on that side, which upon the discharge of the flatulency was streight carried off. If I had not myself seen these particulars upon opening the body, I own I could scarce have imagined that so large a vein could have been so compressed by a flatus, as to have brought on the hazard of an approaching mortification.

3. Intense cold.] We have already observed in the commentaries upon §. 117. that the particles of the blood may be so joined together by cold, as to become impassable; and therefore may form obstructions. If now we suppose an intense cold to have operated so vehemently upon any part of the body as to have congealed the liquids which ought to flow through the vessels belonging to it, it is plain, that all vital influx and efflux of the humours in such a part must be entirely taken away, and a genuine gangrene succeed of course, or even a sphacelus, if the force of the cold shall have extended as far as to the bones. It is true indeed, that the blood and its serum require a greater degree of cold, before they can be congealed, than water; and also, that the heat of the body in a healthful person is capable of resisting a very intense degree of cold, if at the same time care be taken to keep it in a brisk motion: and yet we find, from the many sad examples which are every day seen in the northern countries, that the extremities of the body are frequently capable

of being so suddenly affected by an excessive cold, as to mortify and fall off. So that the effects of an extreme cold very much resemble the action of a quick fire, when applied to the parts of our body, by suddenly destroying them. This Virgil has beautifully described, when joining the effects of heat and cold he writes thus,

*Ne tenues pluvia, rapide potentia solis
Acrior, aut Boreæ penetrabile frigus adurat.*

Left soaking show'rs shou'd pierce her secret seat,
Or freezing Boreas chill her genial heat,
Or scorching suns too violently beat.

GEORGIC. Lib. i. v. 92, 93.

And yet the gangrene and sphacelus which proceed from a severe cold, have certain distinct symptoms whereby they differ from all other gangrenes, as shall be shewn in §. 427, no 6; and also require a different method of cure, of which we shall treat in §. 454 *et seq.* But nothing so much promotes the progress of a gangrene arising from cold, as exposing the part affected immediately to a considerable heat. A servant employed in cleaning a very deep well in the month of July, was of a sudden seized with a violent coldness, and at the same time felt an excessive pain in the great toe of his left foot, which presently rose upwards to his ankle: this whole part was found to be affected with a true sphacelus, which within an hour's time spread so fast, that it was got beyond the middle of his leg; and would no doubt have soon after carried him off, if his life had not been saved by an immediate extirpation^c.

4. An obstructed perspiration, &c.] How very prejudicial an obstructed perspiration is to an inflammation, and what terrible inflammations do sometimes arise from the outward application of fat substances to the skin, especially if any acrid ingredients be intermixed with them, we have already shewn in the commentaries upon §. 376. It has farther been observed in the commentaries upon §. 390. concerning astringent, cold, and emplastick applications, &c. that these are all apt to promote the sudden change of an inflammation

mation into a gangrene. For a phlegmon properly so called has its seat only in the narrower parts of the larger vessels, which are either naturally capable of admitting the red blood, or at least when dilated; so that though the motion of the humours through the larger vessels may hereby meet with an impediment, yet the circulation through the lesser vessels may notwithstanding continue free: but a gangrene then only takes place, when in any part there is no vital influx and efflux of the humours in all the several series of vessels; and consequently whatever hinders perspiration in an inflamed part must contribute to the rise of a gangrene, as it takes away the motion of the liquids through the smaller vessels, at the same time as the larger vessels are made impervious by the inflammation. And thus we learn from observation, that such applications to the parts affected with a phlegmon have been frequently attended with very bad success. A young woman, in a violent continual fever, during the dog-days, falling into a warm sweat upon a critical day, plunged her hands into a vessel of cold water just drawn out of a well: Her hands immediately grew full of pain, and swelled up as high as the water had reached, and by degrees grew livid: and though by deep scarifications, and the application of other remedies, her life was saved by Hildanus; yet the last joints of her fingers in her right-hand mortified and dropt off^d. Several other instances of the like nature are to be seen in the *Miscellanea Curiosa*, which confirm the truth of what we have here related.

But no circumstance more frequently produces a gangrene than the application of such substances to an inflamed part, as by their stimulating acrimony increase the motion in the part affected, and more especially if the circulation be accelerated by the use of resembling medicines internally given. For we have already shewn, in the commentaries upon §. 388. that the acrimony and violent motion of the humours will convert an inflammation into a gangrene. To this cause

C 2

has.

^d Hildan. de Gangr. et Sphacelo, cap. 4. p. 774. ^e Decur 2. ann. 3. p. 145. ann. 4. p. 203.

has been owing the fatal event often seen in inflammatory diseases, where the chemists have thrown down such plentiful doses of their oily volatile salts, and other sharp medicines of a resembling nature, under a pretence of extenuating; as also from the outward applications which the surgeons have made of spirit of sal-ammoniac, alcohol, &c. to such parts as have been inflamed.

5. An internal or external inflammation.] How a phlegmon is converted into a gangrene, has been already observed in §. 388. But we there spoke only of such a case as affected the external parts, and shewed the conversion of an inflammation into a gangrene by a sensible change of various appearances. In the mean time it is very certain, that a true phlegmon, and all its consequences, such as suppuration, gangrene, and scirrhus, may alike take place in the internal parts, as shall be seen hereafter when we come to treat of Acute Inflammatory Diseases. The same also has been shewn in the commentaries on §. 374 and 379.

6. Wounds, bruises, &c.] Of all these we have spoken in their proper places. And how frequently a gangrene arises from fastening on the bandage too tight, has been shewn in the commentaries upon §. 355.

7. Oily acrid substances, &c.] Consult what has been said of these in the commentaries on §. 376 and 390. For substances of this kind, as they are often very sharp, and by their oily tenacious disposition adhere very obstinately to the parts they are applied to, will be capable of producing a gangrene, even where there was no inflammation before; but will be much more liable to do it, when smeared over a part that is already inflamed. The following unhappy case fell under the view of Dr Boerhaave, in a lady of distinction. Her right leg and thigh were paralytic; and being ordered to rub gently the part affected with a liniment of the *galbanetum Paracelsi*, oil of hartshorn, and the like sharp stimulating ingredients, she, not liking the slowness of the method, laid on a large quantity at once; and then covered the part up closely on every side with a coarse cloth, that the virtue of the medicine

cine might not fly off. But as there was some sensation still left in the part affected, in hopes of a sudden cure she overlooked the pain she felt, and the next day both leg and thigh were found to be gangrened. From which case it is very evident, that the use of oily and acrid substances together is very dangerous, if imprudently applied.

8. Lying upon the part affected.] This is one of the most common causes of a gangrene: for when we lie down, the whole weight of the body rests upon a very few places only; from whence a slight inflammation and pain shall arise by compressing the vessels, which will immediately cease upon changing the posture. For this reason persons in the most perfect state of health every now and then change their position whilst they sleep, and thereby easily prevent any ill consequence of this kind. But when, in such very painful diseases as the gout, rheumatism, and the like, the diseased are obliged to lie motionless, as they find their torments to increase upon every the least movement of the body, the arteries and veins in that part which support the weight of the body, being thereby compressed, all vital motion is suppressed, and a gangrene follows. And yet a gangrene never arises from this cause more frequently, or suddenly, than in acute distempers, which are often attended with such an insensibility as prevents the diseased from taking notice of the slight pain and uneasiness which occurs in the parts that are compressed by being lain upon, and then their spirits being low they usually lie on their backs. Now (as we have already observed in the commentaries upon §. 112, n° 4. whilst treating of the causes of an Obstruction) when a man lies thus in an horisontal posture, the bed is always pressed down in the middle, and rises up both in the upper and lower part of it, so that the whole weight of the body lies almost entirely upon the *os sacrum* and the *os coccygis*, which are covered only with the common integuments and a little fat. The soft parts therefore which lie upon them are by this violent pressure deprived of all vital influx and efflux of humours, and die very soon; nay, these bones

themselves shall sometimes be corrupted; so that the the unhappy persons labouring under this disorder shall be obliged to struggle with the difficulties of a long and tedious cure, if they escape at last. The change of posture alone is sufficient to prevent all these inconveniencies; for if the parts affected be but freed from this pressure six times, for instance, in four and twenty hours, the vessels will be opened by the humours that are impelled into them, and life be restored to the part. Care is also generally taken to lay the part naked upon very soft leather, which is an excellent remedy in this case. But if the skin be rubbed off, and a slight excoriation happen, it is customary to lay upon it a plaster of the *empl. diapompholygos*, or some such like, with a little fine powder of *ceruss* or *lapis calaminaris* sprinkled upon it. But if by reason of very great weakness, or for any other causes, it is scarce possible for the patient to change his situation so often, it would then be adviseable either to keep the body suspended by proper girths, or to lay under him pillows made in the form of a ring, stuffed with straw, and covered with very soft leather, in such manner as to keep the parts, which are in danger, absolutely free from all pressure. Physicians therefore cannot be too frequently reminded to have the gangrene arising from this cause perpetually in their thoughts, as often as they observe their patients in acute distempers to be dull and drowsy; for within the space of a very few hours the parts adjacent to the *os coccygis* shall be frequently mortified. Nor is this place only subject to a mortification from being lain upon, but I have also seen a gangrene from the same cause about the *scapula*, the protuberances of the *os ischium*, the larger *trochanters* of the *os femoris*, and even about the processes of the *vertebrae* in a very lean man. We have already pointed out, in the commentaries on §. 354, the many grievous disorders which arise from the surgeons neglecting the complaints of their patients in the cure of fractures, and not making them change the position of the part. Hippocrates, treating of the cure of very bad fractures, gives the following advice: *We must always bear in mind, that the parts, which lie*
long

long in the same position, are liable to excoriations, that are not easily cured^e. The word he uses here is *εκτριμματα*, which signifies *excoriations, attritions, gallings*; and with very good reason: for when any part of the body begins to suffer from being lain upon, there first arises a red spot, and after this the skin seems to be rubbed off; and whilst unskilful people think it a matter of no consequence, a blackness shall follow within a few hours after, indicating an ensuing mortification of a very bad kind.

9. Ruptures, where the intestines are entangled and cannot be replaced.] Though the name of *hernia* or *rupture* is commonly given to several very different diseases; as for instance, when the coats which surround a testicle, or the scrotum itself, are filled with extravasated lymph, we call the disorder an *hernia aquosa*, or watery rupture; if the testicle be grown scirrhus, or converted into a fungous mass, as it sometimes shall be in a surprising manner, it is called an *hernia carnosa*, or fleshy rupture; if the veins dispersed along the spermatic chord become carious, it is named an *hernia varicosa*, or carious rupture; &c.: Yet in this place those ruptures only are understood, which arise from the falling of the parts contained within the abdomen out of the abdominal cavity through the dilated or bursten peritonæum. For as the intestines, which are pendulous from the mesentery, and the omentum, in a manner fluctuate within the abdomen; for this reason these parts are more peculiarly than others liable to fall through the peritonæum, if dilated or broken. We have already observed, in the commentaries on §. 307, that ruptures may be produced in any part of the abdominal circuit, and the other parts besides the intestines or omentum do sometimes thus slip out of the cavity of the abdomen: but yet the most common ruptures are such as proceed from the dilated peritonæum passing through the navel, or in the groin through the rings of the abdominal muscles. In these cases the ruptures are usually called *umbilical* or *inguinal*; and the

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^e Recordandum est, quod loca illa, in eodem situ longo tempore jacentia, excoriaciones curatu difficillimas faciunt. *De Fracturis. Charter.*
Tom. X. p. 245.

last sort, if the descent be into the scrotum, are called *scrotal*; but if their tendency lies only towards the thighs, as is frequently the case with women, they are then called *femoral*. If now, for instance, the dilated peritonæum, with part of the intestine, shall have passed through the rings of the abdominal muscles, it is plain the intestinal tube must lie double within these rings, unless, as in some rare cases, the part of the intestine opposite to the mesentery being gradually dilated, be thrust through the said rings, and so, being converted into an appendage, lengthens by degrees). The chyle, therefore, and other matters contained within the cavity of the intestinal tube, must by its peristaltic motion be necessarily driven hither, frequently without being able to return, whilst that intestine is pent up in the narrow passage of the abdominal ring. A like circumstance may likewise be occasioned by flatulencies distending the intestine when thus slipped down. Such a rupture is termed a *rupture pent up and confined*, as neither the intestine that is slipped down, nor the matter contained within its cavity, are capable of passing back into the abdomen. This case is attended with excessive pain, and a perversion of the peristaltic motion, vomiting, hiccoughs, &c. and the intestine thus pent up will frequently gangrene in a few hours time; and what seems still stranger, the most robust person shall be carried off under these circumstances almost in an instant. For after the most excruciating torments, on a sudden the pain shall entirely cease; and whilst the unhappy creatures think all things safe, they shall drop in a moment. These deceitful symptoms, however, cannot easily impose upon physicians and surgeons of judgment, as the coldness of the extreme parts, the cadaverous countenance, the cold sweats, and livid colour of the mortified intestine, which is frequently to be discerned through the intestines, are sufficient indications of approaching death. From the discoveries already made concerning the fabric of the human body, it does not seem to me a thing easy to be explained, why so sudden a death should so frequently follow upon a confined rupture. We learn indeed from the ob-

servations

Observations made by physicians and surgeons, that the abdominal nerves have a wonderful influence over the vital functions. Thus in the commentaries upon §. 170, n^o 3. we took notice, from the observations of Ruysch, that a wound in the abdomen, which had touched the mesentery, was attended with very severe pains, and in a few days proved mortal, though no hurt of consequence was found in any other part of the body: And yet, from the accounts given of wounds in the abdomen by writers of the best credit, it was plain, that large portions of the intestinal pipe have been either cut away, or spontaneously separated, without loss of life; and we shewed farther in the same place, that a laceration of the intestines would admit of being sewed up, and that by passing a needle through the mesentery the two extremities of the wounded intestine might be brought to the aperture of the wound made in the abdomen, be sewed together there, and again unite. In such a case, where we have reason to apprehend a mortification from a confined rupture, the patient is to be brought so low by plentiful bleeding, that the inflammation arising from it may not be increased by the impetus of the vital motion; and then narcotics are to be given, in a small quantity at a time, every half quarter of an hour, till the pain abates: in the mean time emollient fomentations must be constantly applied to the ruptured part, clysters composed of the like ingredients thrown up every hour, and the reduction attempted; which if it cannot be obtained by this means, the only remaining hope is, by cutting through the abdominal integuments and peritonæum, to free the intestine from its confinement, and draw it back into the cavity of the abdomen: As to which operation, see the commentaries on §. 316. But if a gangrene has already seized the ruptured part, for the most part immediate death ensues; or otherwise the putrefied part of the gut being taken away, the upper extremity must be fixed to the aperture, that the fæces may not be discharged into the cavity of the abdomen. In consequence of which, the excrements will ever after be voided at the said aperture, which will form a kind of artificial anus, unless

unless by a peculiar happiness the two ends of the gut can be so united, as to make one continued pipe from the stomach quite down to the anus. Several surprising instances of this kind are to be met with in the commentaries upon §. 317. by which the possibility of such an union is fully demonstrated.

§. 423. **S**ECONDLY, Whatever sharpens the liquids, so as to make them eat thro' and destroy the vessels: as, 1. A long stagnation of a confined and hot humour; whence acrimony (80), corrosion; hence the blood in an aneurism, the pus in an abscess, the water collected in the cranium, thorax, abdomen, scrotum, &c. the liquids extravasated in bruises: 2. An universally bad, unsound, sharp disposition of the liquid falling upon any particular part; as the lymph remaining long in the neighbourhood of a tendon, the ichor of a cancer, the dysenteric flux, the water of a dropsy, the flowing of a feverish, pestilential, variolous, or scorbutic matter towards the fleshy parts, and particularly to the gums.

The blood within us, and all the humours secreted from it (except the bile and urine, in which by stagnation an acrimony will be formed, or at least very much increased), are so very mild in a state of health, that though they be dropt into the eye, or applied to a green wound, they will not excite the least sense of pain; and this indeed was no more than requisite, that the humours might flow with a proper degree of celerity thro' very tender vessels. If therefore our liquids acquire an increase of acrimony by any means whatsoever, the vessels will be destroyed; and thus the vital influx and efflux of the humours will be interrupted, and consequently a gangrene be produced. For which reason the acrimony of the humours was justly ranked (§. 388.) amongst the causes which are apt to convert an inflammation into a gangrene. And the principal causes of such

such an acrimony in our liquids are the following.

1. A stagnation, &c.] It has been shewn in the commentaries on §. 80. that human liquids, even in the soundest constitution, are naturally disposed to putrefy by rest and heat only; and also, that all the food we take down, though of its own nature not liable to putrefy, shall within the space of twenty hours be so changed in our bodies, as to assume a like disposition. If a person in health be drowned, the body after death shall turn wholly to putrefaction in a few days, from the bare stagnation of the liquids and heat of the common air. But the greater the heat is, the more readily will it increase the disposition to putrefy in our humours; unless it be so excessive, as to draw off immediately the moisture contained in them, and leave the *residuum* dry. Thus in a very hot and very dry air the flesh of animals shall not so soon corrupt, and shall sometimes be so thoroughly dried up as not to putrefy at all; whereas if the air be both hot and moist, they will putrefy in an instant. It is farther observed, that if the air have no access to the stagnating humours, they may be kept long free from corruption: For which reason the cause assigned in the text is, A long stagnation of the confined and hot humour.

Blood in an aneurism.] Consult what has been said in the commentaries on §. 112, no 1. and §. 176.; where it is shewn from very faithful observations, that the blood which stagnates in the pouch of the dilated artery has acquired so great a degree of acrimony, as not only to corrupt the soft parts, but even absolutely to destroy the very bones.

The pus in an abscess.] See the commentaries on §. 406.

The water collected in the cranium, thorax, abdomen, scrotum, &c.] We learn from daily observation, that water may be collected both in the greater and lesser cavities of the body; whether this arises from a rupture of the lymphatic vessels and an extravasation of the liquids they contain, or from the watery particles which are exhaled into these cavities not being taken up by the vessels appointed to receive them. Whilst
this

this water is kept from air, it may continue long in the body without any corruption; however, in time it will begin to putrefy, and corrode all the parts that are contiguous to it. When we come to treat of a dropfy, we shall produce authentic authorities to shew, that the omentum, liver, spleen, &c. by being soaked in such a putrid water, have been absolutely rotten; and that even upon opening the bodies of such as have died of an ascites, the by-standers have frequently suffered greatly from the fetid smell of the filth that has been collected. A gangrene has frequently arisen from this cause in an anasarca of the legs and thighs. For as hydropical persons are constantly cold, it has often happened, that, by sitting too close to the fire, or warming their feet too near a stove, they have raised a blister on the skin; which, when broken, has discharged a large quantity of water, and given great relief. And yet, as the serous liquid oozing out of this aperture has grown more acrimonious by the access of the external air, a gangrene has frequently followed in this case; whilst the panniculus adiposus, which before was so monstrously distended, falls flaccid upon the parts below it, and is in part corrupted by the acrimonious serum continually falling upon it, and partly mortified through the weakness of the vital powers.

Liquids extravasated in bruises.] See what has been said upon this head in the chapter concerning Contusion.

2. An universally bad, unsound, &c.] That sound and mild humours may become acrid by stagnation, is plain from what we have already observed: but it shall farther sometimes happen, that both the blood and the liquids secreted from it shall acquire a greater degree of acrimony than naturally belongs to them, though they still keep on their usual course in their respective vessels. It is true indeed, that there seldom or never happens any great degree of acrimony in the blood, as this circumstance would soon destroy the very small and tender vessels; and yet there is sometimes an acrimony inherent in it, which produces no very sensible effects, whilst it remains mixed with the whole mass, but, when separated from it, and collected in some

some particular parts of the body, shall prove highly detrimental. Thus, for instance, the poison of the venereal disease, whilst mixed with the circulating humours, scarce discovers any sign of its malignity; but when this latent venom is thrown upon any particular part, the very hardest bone shall not escape the force of its corroding quality. If therefore any morbid acrimony inherent in the blood shall fall upon particular parts, or if humours sharper than ordinary be separated from the blood and lie long in any particular place, the smaller vessels may thereby be eroded and destroyed, and by this means the vital influx and efflux of the humours be prevented, that is, a gangrene be produced.

Lymph remaining long in the neighbourhood of a tendon.] We have observed, in the commentaries on §. 163, that the wounds of nerves and tendons, when they are not totally divided, are frequently followed by a very large discharge of a thin, sharp, serous liquid: and at the same time we remarked, that such cases are never attended with a laudable suppuration: but that an ichorous matter being collected in sinuses, shall so entirely corrupt the fat which lies between the muscles, as to make it gangrene, and often come away in this condition in large lumps, that the very pinguedinous sheaths of the tendons shall be thus destroyed, and by this means the muscles for the future become motionless, and the use of the member be absolutely lost. Celsus has called this liquid by the name of *ichor*; and speaks of it thus: *Ichor is a thin whitish matter issuing from an ulcer of a bad kind, and more especially where there is an inflammation following upon a wounded nerve. Melicera is thicker, more glutinous, and of a whitish colour, not much unlike to pale honey. This also is discharged from ulcers of a bad kind, where the nerves are wounded that lie near the joints, and more especially about the knees*^a. And as wounds near the joints are sometimes accompanied with the discharge of such an ichorous

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matter

^a *ἰχὼρ* tenuis, subalbidus, ex malo ulcere exit; maximeque ubi, nervo læso, inflammatio secuta est. *Μελίκερα* crassior est, glutinosior, et subalbida, mellique albo sublimilis. Fertur hoc quoque ex malis ulceribus, ubi nervi circa articulos læsi sunt; et inter hæc loca, maxime ex genibus. *Lib. v. cap. 26. n^o 20. p. 288.*

matter; and the neighbouring joint becomes motionless for ever after, our surgeons have therefore given this disorder the name of *leedenwater* or *joint-water*; and ^b Hildanus has very properly expressed it by the compound word *hydrarthron*. And as the persons who labour under this disorder are afflicted with a sharp burning pain, it is usual with them to throw the blame upon the excessive acrimony of the lymph, which falls upon the part affected; whereas possibly the pungency of the pain may arise from the distraction of the nervous or tendinous filaments by a slow dilaceration. In the mean time it is certain, from many accurate observations, that the continued afflux of such a kind of lymph to the tendinous parts for any length of time is almost constantly followed by a gangrene, whether it be owing to the acrimony of the humour, or that when the blood is robbed of this diluting vehicle the most obstinate inflammations are apt to ensue. Hildanus has given us a discourse entire upon the subject of the *ichor* and *meliceria*, in which we meet with a great number of cases, all serving to confirm the truth of what we have here laid down.

The ichor of a cancer.] For in this very calamitous disease the humours are frequently so very acrimonious, as even to burn the cloths that are applied to it like *aqua fortis*, and eat away the neighbouring skin thro' which they flow, to a considerable depth. Now, as we shall shew hereafter, there have been cancers found not only in the external, but also in the internal parts; and it is easy to conceive, what terrible effects must follow when so sharp a poison preys upon the inward parts of the body.

The dysenteric flux.] If, for instance, the venom of a cancerous liver or pancreas, falling into the intestines, shall bring on a continual tenesmus, attended with horrible griping; it is plain, that, by thus eroding the intestines, a true gangrene may be produced. So when the swelling *atra bilis* shall be set in motion by the heat of the air, by exercise, or any other cause whatsoever, and an atrabilarious dysentery be brought

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on with intolerable pain, how soon after shall a mortification of the bowels frequently follow, and that easy death which succeeds the cessation of the pain!

The water of a dropsy.] We observed above, that the water in hydropical persons shall sometimes be entirely drawn off by an aperture, made either casually or by art in the legs; but, at the same time, that it shall frequently in this passage bring on a mortification of the parts which lie near the aperture: And we learn likewise by experience, that the same water will sometimes be licked up again by the veins; and, being mixed with the circulating humours, shall be carried off by stool, urine, &c. *If water in a dropsy (says Hippocrates) be thrown back into the veins and pass off thence by stool, it will carry off the disease^c.* If now these waters shall by length of time, and from their stagnation, begin to putrefy before they are licked up again by the veins, this putrefaction will increase, whilst they circulate with the blood through the vessels: and if they are then excreted by the mesenteric vessels into the cavity of the intestines, the villous coat of the intestines, by being continually soaked in this putrid water, shall grow tabid; and by this means rottenness, mortification, and death, are so frequently the consequence. For this reason, Hippocrates has in another place given us a more limited sense of the maxim he laid down in the passage we have quoted above: *Watery stools (says he) coming on in the beginning of a dropsy, without crudity, carry off the disease^d*; for in this case there could not be as yet any hazard of putrefaction.

The flowing of a feverish matter, &c.] A fever, as we shall shew when we come to treat of it in a distinct chapter, does frequently so change and overpower the material cause from whence it has been derived or by which it is supported, as to bring on a perfect restoration of all the functions without any evacuation. Sometimes also the peccant matter, which lies hid in the body, is so changed by a fever, as to become moveable;

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and.

^c Hydropicis, secundum venas aqua in alvum prorumpente, solutio fit. *Coac. Prænot. n° 461. Charter. Tom. VIII. p. 879.*

^d Hydropi incipienti, alvi profluvium aquosum superveniens, citra cruditatem, morbum solvit. *Ibid. n° 457. p. 878.*

and is either expelled out of the body, where, if suffered to continue, it would still go on to disorder the several functions; or is deposited upon some particular parts by abscesses. Nor is it of consequence whether the matter thus deposited did exist in the body before the access of the fever, or was produced afterwards; as in both cases it has the name of *feverish matter*. When, therefore, this feverish matter is deposited by abscess upon some particular parts of the body, it shall not only occasion erysipela's, phlegmons, and suppurations; but will sometimes in an instant extinguish life in the part affected, from whence a gangrene and sphacelus shall presently after follow.

Upon another occasion (in the commentaries on §. 253.) I mentioned an extraordinary case in a man of fifty years of age, who in an acute continual fever had the extremity of his right foot mortified in one night's time, which afterwards dropped off: and yet he recovered; for as soon as the malignity of the disease had fallen upon this part, the fever left him, and health was restored to the rest of the body. In an old woman of seventy, under a severe fever^e, Tulpius was surprised to find, that the pestilent humour of the disease had seized upon her left-arm with so much violence, that from the articulation of the shoulder quite down to her fingers ends the whole was mortified in one night's time, to such a degree, that the skin was quite black, and the flesh underneath as discoloured and dry as if it had lain for a month together exposed to the sun in the most excessive heats of summer. A like instance he tells us he had seen in another woman; and we have several cases of the same kind reported by other writers of observations. Hippocrates had also observed, that life was sometimes saved by the loss of a particular part; and has left the following remark to physicians upon this occasion: *It is much better to have the feet and toes quite black, than livid. But it will be adviseable in this case to take all the other symptoms into consideration: For if the patient seems to bear this circumstance well, and in other respects appears to be better*
than

than before, there is reason to hope that the disease may go off by abscess, and the patient escape with life, losing only the parts that have turned black^f.

Pestilential.] All the writers who have treated of this terrible disease agree in this, that if the virulence of the distemper should happen to fall upon any particular part, it would immediately be destroyed, inasmuch that the mortified part, though adhering to the parts contiguous wherein there was life, behoved to be afterwards cast off by a suppuration formed in the parts which should surround it. The name of *pestilential boils* has been given to such spots, thrown out upon the surface of the body, as have resembled the marks made by the application of actual fire. And the disorders which attended the plague at Athens, described by Thucydides^g, who was not only a spectator of what others felt, but was himself afflicted with the disease, were still more terrible. The most healthful people were in a moment seized with violent pains in the head, with redness and inflammation in the eyes; presently after, the tongue and jaws grew red, and the breath became foul and fetid. These symptoms were followed with a sneezing and hoarseness: then the disease spreading itself into the breast, brought on a violent coughing: to this succeeded bilious vomitings; very troublesome hiccoughs; an intolerable inward heat, whilst no extraordinary heat could be outwardly discerned; the body in the mean time assuming a livid purple hue, and being overspread with small pustules and ulcers. Thus by degrees the disease seemed to fall from the head to the lower parts, whilst those, who had got over the seventh or ninth day, the disease having by this time diffused itself into the lower belly, sunk under the violence of the exulceration and largeness of the flux. But in case the fury of the distemper reached the extremities, the greatest danger was looked upon

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^f Pedes autem, digitique, penitus nigri minus perniciosi sunt lividis. Sed et alia signa considerare oportet. Nam si æger malum leviter ferre videatur, atque aliquid signum salubre præterea se ostendet, morbum in abscessum versum non spes est; sic ut homo quidem superstes evadat, partes vero corporis denigratæ decidunt. Hippocr. Prognost. Charter. Tom. VIII. p. 624.

^g De bello Peloponnesiaco, lib. ii.

to be over: and several thus escaped; though some of them not without the loss of their fingers and toes, sometimes of the genital parts, and sometimes of the eyes; thus drawing a tedious life along, in itself more calamitous than death. Galenⁿ speaks of a plague which seized upon the toes and mortified them.

Variolous.] For, in a very bad sort of the confluent small-pox, the whole face shall be covered over with a gangrenous crust; and this crust bursting, there will be discharged a thin ichorous matter, frequently very fetid, which makes miserable work with the skin and *panniculus adiposus* that lie underneath. I even remember to have seen, what Sydenham had before taken notice of, incruusted bladders of this kind rising upon the thighs, to the bigness of a hen's egg, filled with a thin ichor and bloody matter, which when bursten have discovered the skin underneath to be turned quite black.

The flux of a scorbutic matter to the fleshy parts, and particularly the gums.] The scurvy is attended with this extraordinary circumstance, that it weakens the cohesion of the vessels to such a degree, as to make them liable to be ruptured by every little force. Thus if any part of a scorbutic person be more roughly handled than ordinary, an ecchymosis shall follow in it, the blood being extravasated from the broken vessels which lie under the unbroken skin. Nay, frequently without any external violence, there shall be black and blue scorbutic spots seen, formed either from the rupture of the vessels by the motion of the adjacent muscles, or their erosion by the acrimony of the blood. For an acrimonious disposition of the blood constantly attends the weak cohesion of the vessels in this disease; as shall hereafter be shewn, when we come to treat of this distemper. It is therefore by no means surprising that a gangrene should be the consequence of a flux of scorbutic matter to the fleshy parts, from the destruction of the vessels. The very bad ulcers in the legs, which scorbutic persons are subject to, that are so unapt to yield to the most effectual applications, are found by daily observation very liable to mortify. Nor have we any
where

where more early indications of the scurvy, nor are any parts sooner corrupted by it, than about the gums. These begin to grow hot, to be painful, to itch, and upon every the slightest rubbing pour out blood: after this, they shew certain white spots, which are red and inflamed round their edges; and, if neglected, spread and prey upon the neighbouring parts, especially in younger people; and are attended with a dreadful stench, and a plentiful flux of a very thin and fetid saliva from the mouth. This disease in Holland is called the *waterkanker*; as it is apt to eat away all that lies near it like a cancer, and is accompanied with the continual discharge of such a kind of saliva. And unless this disorder be carried off in the beginning, which may certainly be done by washing the mouth well with a mixture of spirit of sea-salt and common water, and afterwards with other acid fossils, salt-water, &c. it will not only putrefy the gums; but also the cheeks, lips, and tongue; and even reach to the teeth, and bony substance of the jaw, and make them fall out. The free access of the air, the warmth and moisture of the place, the frequently very sharp and putrid lymph which in a bad sort of scurvy is continually falling upon these parts, do likewise greatly add to the increase of the putrefaction here when once it is begun.

§. 424. **T**HIRDLY, Whatever promotes the death of the extreme parts by a defect of the vital influx of the liquids; such as cessation from motion in old people, extreme weakness, violent contusions of large nerves, the backbone, the spinal marrow, large ganglions (326, 420).

As a gangrene is such a state of the soft parts of the body, as, from the abolition of the influx of the vital humour into the arteries, and its efflux through the veins, has a tendency to death; it is very evident, that it cannot but be produced, when the causes which convey the humours through the vessels are become so weak,

weak, as not to be able to continue the motion to the extremities of the body. Now the causes which perpetuate the motion of the humours through the vessels, are, The force of the heart that fills and dilates the arteries; and, The power of the arteries, whereby they are capable of contracting themselves, and propelling the blood driven into them by the heart through their narrow extremities into the veins. The flux of the venous blood returning to the heart is likewise farther promoted by the motion of the muscles adjacent to the veins. When therefore, in old age, or thro' extreme weakness arising from any other cause, the powers of the heart are so far diminished, that the impulse of the blood thrown into the arteries is no longer capable of dilating them to the extremities of the body, the cessation from motion then begins to take place in old people, and from thence a gangrene of the extreme parts. Besides, there is required in the arteries such a degree of flexibility, as shall let them give way and be dilated by the impulse of the blood driven from the heart; and withal such a degree of strength, as shall enable them, when the action of the heart ceases, to propel the blood contained within their cavities by their own elasticity and the action of their muscular fibres. From whence a like effect will follow from the opposite defect of the solid fibres, and the vessels which are composed of them; namely, an interruption of the uniform motion of the blood, and its stagnation.

That the motion of the humours through the vessels is interrupted by the too great weakness and laxity of the fibres and vessels, has been proved in the commentaries on §. 26 and 44. And that the same disorder may be occasioned by the too great rigidity of the fibres and vessels has been also shewn in our remarks upon §. 33. and 52.

But as, in extreme old age, the sides of many of the vessels become collapsed and grown together, which were pervious in youth, (see the commentaries on §. 43, n^o 4.) the vessels do hereby obtain too great a degree of strength and callosity, by which means they are not so easily capable of being dilated, and of consequence

sequence the heart can no longer throw out the whole quantity of blood contained within its cavities, and of course it must stagnate there. Consult what has been said, in the commentaries upon §. 128. concerning the inevitable necessity of death arising from this cause. We have a remarkable case recorded by ^a Tulpius, which fully confirms what we have here advanced. In an old dotard, who had long struggled with weakness, the power of the heart became so languid, and the heat of the parts so far extinguished, that every the least pressure upon any part of the body was immediately followed with a gangrene. For whether he sat upon his breech, or leaned upon his elbow, or set his foot upon the ground, or bent his head against the wall, both the part pressing and pressed was immediately seized with a gangrene; so that the mischief spreading itself within a short time over the whole body, every part about him was almost mortified before the miserable wretch was actually dead. I myself have seen a resembling case in a woman of ninety, whose extreme parts were not only mortified before she died, but also the cheek which lay on the pillow whilst she slept. In these people the powers of the heart seem to have been so weak, as not to be able to disentangle the vessels which were folded together by the slightest pressure.

The history of physic furnishes us farther with another cause of an incurable gangrene; namely, when the arteries are grown so stiff, or even boney, as they sometimes are, that they can neither yield to the impulse of the blood thrown into them by the heart, nor be able to contract themselves, though the force of the heart shall still remain sufficiently strong^b. A gentleman of sixty-seven years of age, who all his life before had enjoyed a very good state of health, was seized with a mortification in one of his toes, which by gradual advances had reached half-way up his leg. As he otherwise found himself in pretty good spirits, and his pulse was strong and regular, the courageous old man chose rather to try an uncertain remedy, than submit

^a Observat. Medic. lib. iii. cap. 46. p. 262.

^b Philos. Transact. n^o 369. p. 226. Abridg. Tom. VII. p. 571.

mit to a certain death, which he saw gradually coming upon him; and consented to the amputation of the gangrened leg. The leg being taken off, about two or three ounces of blood issued out from the muscular part; but upon slackening the tourniquet, which compressed the artery, the very skilful surgeon, who performed the operation, was not a little surprised that not one drop of blood flowed out, and that upon feeling the extremity of the artery he found it hard and callous. About four days after the operation, the gentleman died. Upon examining the leg, the larger trunks of the artery were for the most part ossified; and in some places so contracted, that their cavities would barely admit of an hog's bristle. From whence the cause of the mortification was visible enough.

As, therefore, gangrenes of this kind are almost constantly owing to an incurable defect in the vessels, or to a weakness in the heart which cannot be remedied; it is plain, that neither the separation of the corrupted part by suppuration can in this case be expected, nor any relief hoped for from amputation. All that is left therefore to be done, is to apply salt, vinegar, wine, rue, scordium, and such like ingredients, to the part affected; by these means keeping it as much as may be from putrefaction, and at the same time recruiting the patient's spirits as much as possible with nourishing food and cordials. By this means Dr Boerhaave prevented a mortification begun in the great toe of a magistrate in this city from spreading for full six months; but when, upon a consultation with other physicians, it was judged adviseable, by a majority of voices, to attempt the separation of the mortified part from the sound by suppuration, and to this purpose ripening cataplasms were applied, in three days time the mortification ran up as high as the thigh, and the patient gently expired in a very short time after.

Why a gangrene should follow upon large contusions, or rather notable hurts of great nerves, ganglions, the spine or spinal marrow, has been already explained in the commentaries on §. 162.

§. 425. **F**OURTHLY, Surprising poisons.

Besides the causes of a gangrene already mentioned, there are yet some others which cannot be reduced to the foregoing classes. For there are such substances in nature, as, when applied to the human body, shall both certainly and speedily bring on the death of the part, and even of the whole, though their manner of acting cannot as yet be physically accounted for. For as frequently nothing occurs in the sensible qualities of the poisons, to which so wonderful a power can be justly ascribed, Galen and the schools after him have said, that their whole substance is noxious, and that they act by an occult quality. The more modern philosophers, who have judged it a reproach to seem ignorant of the causes of any appearance, have exploded these occult qualities, and laughed at the simplicity of the ancients, who, freely owning their ignorance, stood amazed at those effects which they could not any ways account for. But with much more reason did the viper-catcher of the Grand Duke laugh at the philosophers who were disputing concerning the venom of the viper, (see the commentaries on §. 155.) when he confuted their arguments, by drinking off not only the bile of a viper; but also the saliva, froth, and poisonous juice, which is lodged in the receptacles lying behind the teeth, of a large and enraged viper, in a glass of wine. For though poisons shall prove noxious in a wound, yet may they often be swallowed without injury. And therefore ^a Celsus does not ascribe to the *Pfylli*, whose business it was to suck the venom out of poisoned wounds, any peculiar knowledge, but only a large share of boldness confirmed by use. And for this reason he concludes, That if any person, in imitation of the *Pfylli*, shall suck a wound of this nature, he will both relieve the person wounded, and receive no injury himself. Only, says he, let him be careful, that he has no exulceration either in his gums, palate, or any other part of his mouth.

We

^a Lib. V. cap. 27. n^o 3. p. 309.

We have seen in §. 423. that sometimes, in diseases, there shall be something formed so noxious to human nature, as immediately to bring on the mortification of that part of the body whereon it falls. We observed in the same place, that the venom of the small-pox is in a few days capable of spreading such an universal corruption over the whole body of the most healthful youth, as to leave no part free from the putrefaction. We learn farther from experience, that both a gangrene and sphacelus may arise from a very small bite of a venomous animal. ° When Cato led his army thro' the deserts of Libya, which abounded with animals of this kind, amongst the rest was a little serpent named *Seps*, which gave the wretched soldier but a small wound in the leg, and immediately

—————*plagæ proxima circum*
Fugit rupta cutis, pallentiaque ossa retexit.
Famque sinu laxo nudum est sine corpore vulnus,
Membra natant sanie, suræ fluxere, sine ullo
Tegmine poples erat; femorum quoque musculus omnis
Linquitur, et nigra distillant inguina tæbe, &c.

—————around the part, the skin withdrew,
 The flesh and shrinking sinews backward flew,
 And left the naked bones expos'd to view. }
 The spreading poisons all the parts confound,
 And the whole body sinks within the wound.
 The brawny thighs no more their muscles boast;
 But, melting, all in liquid filth are lost:
 The well-knit groin above, and ham below,
 Mixed in one putrid stream, together flow:
 The firm peritonæum, rent in twain,
 No more the pressing entrails cou'd sustain; }
 It yields, and forth they fall, at once they gush amain. }

Thus by gradual advances were the abdomen, the breast, and the viscera they contained, all affected; till at length, as the poet adds, rottenness entered the very bones, and that too without delay.

—————*Omne,*
Quicquid homo est, aperit pestis; natura profana
Morte patet, manant humeri, fortisque lacerti;

Colla

*Colla caputque fluunt. Calido non ocyus austro
Nix resoluta cadet, nec solem cera sequetur.
Parva loquor, corpus sanie stillasse perustum,
Hoc et flamma potest, sed quis rogus abstulit ossa?
Hæc quoque discedunt, putresque secuta medullas
Nulla manere sinunt rapidi vestigia fati.
Cyniphias inter pestes tibi palma nocendi est;
Eripiunt omnes animam, tu sola cadaver.*

Small relics of the mould'ring mass were left,
At once of substance, as of form, bereft;
Dissolv'd, the whole in liquid poison ran,
And to a nauseous puddle thrunk the man.
Then burst the rigid nerves, the manly breast,
And all the texture of the heaving chest:
Resistless way the conqu'ring venom made,
And secret nature was at once display'd;
Her sacred privacies all open lie
To each profane, inquiring, vulgar eye.
Then the broad shoulders did the pest invade,
Then o'er the valiant arms and neck it spread;
Last sunk, the mind's imperial seat, the head.
So snows dissolv'd by southern breezes run,
So melts the wax before the noon-day sun.
Nor ends the wonder here. Tho' flames are known
To waste the flesh, yet still they spare the bone:
Here none were left; no least remains were seen;
No marks to shew, that once the man had been.
Of all the plagues which curse the Libyan land,
(If death and mischief may a crown demand),
Serpent, the palm is thine: tho' others may
Boast of their pow'r to force the soul away;
Yet soul and body are to thee alone a prey.

Perhaps the poet's credit may here be suspected, and he may be imagined to have taken a poetical licence in describing the horrible mischiefs consequent upon the bite of this serpent. But in the commentaries on §. 105, we gave a case which very nearly comes up to it. A very venomous serpent had bit a young woman in perfect health, who died soon after the bite; and whilst, within a few hours after, the persons about her were attempting to remove the body, the putrefied flesh fell off from the bones.

There lies frequently concealed a deleterious quality in some substances, which would never have entered into any man's thoughts, if experience had not taught us that they contained such a malignant disposition. Thus it has been observed in France, that grains of rye (and especially if put into the ground in March) sown in a moist and cold soil, in a very wet season, have, when grown up, produced very bad ears, of a black colour, and in shape resembling the spurs of a dunghill cock. And when, through scarcity of provision, the poor people have not been careful enough to cleanse the rye from this bad product, many of them have been seized with a dry, black, and livid gangrene, which has begun in the toes and gradually spread upwards, one only amongst a great number having it beginning in his hand. What was still more wonderful, it affected only the men, and no women, except here and there a young girl: And when some of this faulty corn was thrown to the poultry, they rather chose not to eat at all, than to pick any of it up; tho' when it was fraudulently conveyed down their throats, it seemed not to hurt them. From this surprising observation we learn, that the most wholesome food belonging to mankind is capable of being converted by a latent cause into a real poison.

§. 426. **T**HE signs of a future gangrene are its causes (422, 423, 424, 425) fore-known.

Of all these we have already treated in the numbers here recited. We are now to speak of those signs, by which a gangrene is known to be present; and whereby it is distinguished from the inflammation which goes before it, and the sphacelus which sometimes follows after it.

§. 427. **T**HE signs of a present gangrene are,
1. The symptoms of an inflammation

tion suddenly disappearing, without a due correction of the cause; (compare §. 382, 383, 385, with 422, 423, 424, 425.) 2. A duller sensation in the part affected. 3. A pale, ash, brown, livid, and black hue. 4. Softness, flaccidity, pitting. 5. Pustules in the place inflamed, filled with a yellowish or reddish lymphatic ichor. 6. A great itching and pricking, after coldness; with an intense redness, followed soon after by a mortiferous blackness.

If what we have already said concerning the causes preceding a gangrene, its nature, and place, be well understood; it will easily be distinguished whether there is a gangrene or not, by the following signs.

1. The symptoms of an inflammation, we have observed in §. 381. arose from the vital power impelling the blood into the obstructed vessels with greater celerity; and all these have been enumerated in §. 382. *et seq.* If therefore these symptoms are continually increasing, and then cease of a sudden; we know, that this cessation cannot be owing to a correction of the cause, or resolution of the concremented inflammatory mass, because this circumstance never happens but where the symptoms of the inflammation have been mild; (see §. 386). Nor can there in this case be a suppuration; as the symptoms of the inflammation do not thereby cease, but are gradually, not suddenly, changed, and grow milder. Much less can a scirrhus here be expected, as the alteration in this case is still slower. We have therefore no other consequence of an inflammation remaining, but a tendency towards a gangrene or mortification of the part. And the reason why the symptoms, which accompany an inflammation, then cease, has been already explained in the commentaries on §. 388. When the inflammation seizes upon an external part of the body, a sensible change of colour, with the other signs of a gangrene proceeding from inflammation, may be visibly discerned: And if a resembling disorder seizes upon an inward part, it may

likewise be distinguished by the sudden cessation of the heat, pain, and fever.

2. The inflamed place before was full of pain, from the rending asunder of the nervous fibres dispersed thro' the coats of the distended vessels; when therefore the distending cause, or the vital influx of the humours through the vessels, ceases, the pain will also cease, or at least will be much lessened. For it sometimes happens, that, even after the *panniculus adiposus* is corrupted with a gangrene, the skin shall not be absolutely mortified, so that some sensation will still be left remaining; as also in the parts which lie under the *panniculus adiposus*: which notwithstanding, from the interposition of the mortified and insensible part, have but an obscure feeling of the action of external bodies.

3. We have shewn in the commentaries on §. 382. n^o 1, 2, and 5. that an inflamed place looks red, and the skin shines by reason of the extraordinary tension. But as soon as the motion of the humours through the inflamed part ceases, the florid red colour begins to fail; and, instead thereof, a paleness ensues, which is followed by an ash-colour, brownness, &c. so that according to the different colour of the part affected, the degree of the corruption is different, and is so much the worse as it approaches nearer to a mortifying blackness. These marks of a present gangrene are well described by Galen, where he takes notice, that, in great inflammations, the orifices of the vessels being highly obstructed, and all the passages deprived of their natural perspiration, the parts thus affected will suddenly mortify: *And first of all, says he, the florid colour attending inflammation passes off; and then the pain ceases, and the pulse sinks, not from an abatement of the disorder, but from the want of feeling in the part affected* ^b.

4. So long as the inflammation lasts, an hard rebounding tumour possesses the part, which when compressed immediately returns again to its former state, as
the

^b Ac primum illarum extinguuntur floridus color (αποσβεῖνναι το της χροας ευανδες) qui inflammationibus adfuerat; deinde dolor et pulsus abeunt, non sedato affectu, verum sensu emortuo. De Tumor. præter naturam, cap. 8. Charter. Tom. VII. p. 317.

the impetus of the vital humours pressing upon the obstructed places from behind distends all around them. When therefore the mortification is begun and this impetus fails, the part becomes flaccid, and the *panniculus adiposus*, which before was very much distended, now feels soft, and retains the impression of the finger lying upon it. When the place thus affected is touched, there seems to be a kind of fluctuating matter under the skin, or at least the parts directly under it seem loose; which proceeds only from the corruption of the *panniculus adiposus*, whereof large portions are afterwards cast off, when by a proper suppuration the mortified part is separated from the parts wherein there is life.

5. This is generally looked upon as the pathognomonic symptom, by which a present gangrene in the external surface of the body is capable of being discerned. For as we have observed in §. 388, when an inflammation passes into a gangrene, the vessels are suddenly burst, and let out the humours which are shortly to be corrupted. The cohesion of the very tender scarf-skin with the true skin which lies under it, is dissolved, and raised up into bladders by the extravasated humours, which are filled with an ichor that is sometimes yellowish, and sometimes reddish like the water wherein flesh has been washed; though, in a gangrene of the worst kind, directly tending to sphacelation, bladders of this nature shall sometimes be seen filled with a black ichor.

6. This peculiar species of a gangrene is known by distinct signs. In the northern countries, and in very cold winters, such unhappy cases are very frequent.

For the extremities of the body, the toes and fingers, the tip of the nose, the lobes of the ears, shall from the sharpness of the frost be suddenly seized with so severe a gangrene, as afterwards to fall off. And the progress of this mischief is generally thus. The part affected with the cold is first pale, and then red; this redness is attended with a very troublesome pain, and a violent itching: after this the colour grows deeper, and becomes almost purple; till at last it turns black; and then the part, which becomes sphacelated to the

very bones, falls off. But as the gangrene arising from this cause produces its fatal effects very soon, and requires a very different method of cure from all others, as we shall shew in §. 454. we must therefore be careful not to commit any error in distinguishing the diagnostic signs of it.

§. 428. **A** FUTURE sphacelus is known by a continual increase of the symptoms of a present gangrene.

We have observed, in the commentaries on §. 420, That a gangrene generally goes before, and a sphacelus follows after. If, therefore, all the symptoms of a present gangrene recited in the preceding paragraph be increased, we have reason to apprehend an approaching sphacelus: For the gangrenous parts, by pressing upon the parts underneath them wherein there is life, may either entirely extinguish all motion in them, or corrupt them by spreading the putrefaction.

§. 429. **T**HE signs of a present sphacelus are,
 1. A true gangrene preceding.
 2. The entire loss of feeling and motion in the part affected; so that whether it be cut, pricked, or burnt, though down to the bone, there shall be no sense, except that it shall seem heavy.
 3. A livid, tawny, black hue.
 4. A softness, flaccidity, coldness, looseness of the skin, and at last a dryness and hardness.
 5. A cadaverous smell.
 6. A mortiferous corruption lying deep, and eating into all the adjacent parts, quite down to the bones.

1. This sign serves only to raise the attention of the physician and surgeon: for a sphacelus does not always follow, tho' a true gangrene has preceded; yet there is reason to fear that it may.

2. It is frequently a very difficult matter to determine whether there is a sphacelation or not. For the *panniculus*

culus adiposus, if violently inflamed, oft becomes immensely thick, even in those places where there is very little fat; as for instance, in the back of the hands and feet, and in the fingers and toes. If now a gangrene seizes on these parts, the instrument may be thrust down very deep, without any sense of pain. The *panniculus adiposus* also, when distended, and confined within a whole skin, may so compress the parts underneath it, as to take off from the quickness of feeling, or even to make them insensible, though as yet they may not be quite dead, but capable of reviving as it were again upon the removal of the pressure. So that we cannot conclude that there is an actual sphacelation, unless we be very sure, by the deepest punctures and scarifications, that no pain can possibly be produced; for if there be any life remaining in the parts which lie under the *panniculus adiposus* when gangrened, we may reasonably expect a separation of the part corrupted.

We must farther observe, that motion may often still remain in the part, though absolutely sphacelated. This I saw in the man mentioned in §. 423, no 2. who had the forepart of his foot suddenly sphacelated in a fever; for he could move the toes of the affected foot, though he felt not the least pain from thrusting the instrument quite down to the bone, nor the least drop of blood flowed out. Nor will this seem strange, if we consider, that several of the muscles which move the fingers and toes are placed very high; so that though the extremities of the member be sphacelated, the muscles that are yet sound may by their action move the dead parts, to which they are fastened by their tendons. For the tendons are drawn like cords, while the acting muscles swell; and, as they are very tenacious, will remain sound a considerable time after the other soft parts are putrefied; so that in the case above mentioned, when the mortified parts came to be separated from the sound, we were forced to cut through the cohering tendons with the scissars. As soon as any part of the body is absolutely dead, it feels as heavy as if a weight of lead was fixed to the parts that are sound. For whilst the humours flow freely through all the vessels,

we enjoy a perfect state of health, and feel not the weight of our bodies; but if this free passage meets with any impediment, we then feel heavy and torpid. For which reason it is, that Hippocrates has pronounced ^d a spontaneous lassitude to be the fore-runner of a disease.

3. Consult what has been said under the preceding Aphorism, at n^o 3.

4. We have likewise shewn, in the commentary upon said aphorism, why the part of the body which is seized with a gangrene or sphacelus becomes soft and flaccid. And as warmth arises from the motion of the fluids through the vessels, (as may be seen in the commentaries on §. 382, n^o 6.) if this motion ceases, the part thus affected is of necessity reduced to the common temper of the circumambient air; and is then said to grow cold, because the warmth of a body in perfect health is always greater than the degree of heat that is in the air. And yet so long as there is only a gangrene, the parts underneath, which have life still remaining in them, may give some little degree of warmth at least to the part affected; but where the vital influx ceases quite down to the bone, it is plain that coldness must necessarily be the consequence.

It is usual then for the scarf-skin, which is naturally very tenacious, and not easily disposed to putrefy, constantly to separate from the true skin; thus after a burn, the application of cantharides, &c. the scarf-skin remains whole; and yet when the bands are unloosed, by which it was fastened to the true skin, it will be raised up into bladders by the extravasated humours. Even when a part of an human carcase shall have lain long in water and become putrefied, the scarf-skin shall not be corrupted; but shall separate from the parts underneath, though they be grown quite rotten.

But though in a beginning sphacelation the part thus affected appears soft and flaccid; yet afterwards the most fluid parts being carried off, what is left behind shall be withered, and so dried as to become very hard. For the case is the same with parts that are sphacelated,

red, as with the flesh of animals hung up in the open air; according to the observations of those who feed their dogs on horse-flesh to make them fierce. For this flesh first becomes putrid and rotten, and then grows extremely hard. Even in old bodies, which are lean and sapless, a sphacelated part may be kept a considerable time without putrefaction, but dried up and shrivelled. A very remarkable case of this kind was observed at the Hague. An old woman of about ninety-two, complained of an excessive pain in the tibia of the right-leg. The physician who was called in to her assistance, found the whole leg sphacelated almost quite up to the knee. As the lowness of her spirits, and her extreme old age, would not admit of amputation, it was thought proper to keep up her spirits with nourishing food and cordial medicines, and withal to anoint the mortified part continually with spirit of turpentine, and afterwards to foment it with spirit of juniper. By this means the part was kept from putrefying, and the progress of the mortification stopt: but what was very surprising, the mortified part, shrivelled up like an Egyptian mummy, adhered to the sound parts of the body for almost six months together; and then at last the poor woman died^c. Hildanus^f relates a resembling case, from the observations of Smetius, of a woman who had for a long time one of her feet dry, black, and sphacelated, without any swelling, as also without either motion or feeling; at last the mortified part separated from the sound, and fell off, and looked not unlike a neats-tongue dried.

5. For a sphacelated part goes through just the same changes in the warmth of the common air, as a dead carcase does, whence also there will be the same stench and corruption.

6. As therefore, in a dead carcase, every part shall perish by a spontaneous corruption, except only the bones, which have been found by observation to have lasted for several ages; so also all the soft parts, when sphacelated, unless they be dried up and shrivelled, will become

^c Miscellan. Curios. dec. 3. an. 5 & 6. p. 495.
et Sphacelo, cap. 7. p. 772.

^f De Gangræna

become putrid and rotten, and fall off from the bones. It is also farther observed in a sphacelus, that unless limits be put between the sound and mortified part by art or nature, and the parts on each side of these confines be kept at a distance from each other, the mortiferous corruption will continue to prey upon all the adjacent parts, and with the greater celerity in proportion to the greater activity of life; for which reason, in a young person a sphacelus shall make very quick advances, especially if he has a fever at the same time; whereas in a very old man, provided the mortified part be kept from corruption by antiseptic applications, it will hold out a considerable time. 'Tulpius^g gives an account of a most horrid spectacle of this kind, the severest case he says that ever mortal suffered, and the most dreadful that ever creature saw. A woman of fifty, after most intolerable pains in the belly, had a gangrene, which preyed upon the abdomen in such manner, as to consume the navel, to perforate the peritonæum, and denude not only the mesentery and intestines, but also eat away a great part of the intrails; insomuch that no one could without horror look upon the bloody edges of the skin, muscles, peritonæum, and omentum, or see the viscera lie drenched in filth, and corruption, and the wretched remains of indigested food. Celsus has beautifully described the manner how a gangrene and a sphacelus are wont to spread, in the following words. *The fleshy part of the ulcer is black or livid, but parched and dry: the adjoining skin is generally full of blackish pustules; the next to this is either pale or livid, and in a manner rusty and insensible; and the next beyond is in a state of inflammation: And all these particulars make their advances at the same time; the ulcer passes into the part abounding with pustules, the pustules move forward into the part that was pale, the paleness or lividness into the part that was inflamed, and the inflammation into the part that was sound*^h.

§. 439.

^g Lib. iii. cap. 3. p. 187.

^h Caro illi ulceri vel nigra vel livida est, sed sicca et arida; proximaque cutis plerumque subnigris pustulis impletur; deinde ei proxima vel pallida, vel livida et fere æruginosa et sine sensu est; ulterior in inflammatione

430. **T**HE great and sudden danger attending upon this disease requires a just prognostic.

As soon as the symptoms of a sphacelus appear, upon due consideration, there is no time to be lost, but an immediate resolution must be taken concerning what is to be done for the preservation of life. And if nothing but extirpation is left, it must be attempted without delay. For the mischief advances upon us so fast, sometimes within an hour or two, as to grow past remedy. We have many instances which shew how swift the progress of this disease is; but one remarkable case will suffice at present¹. An healthful woman, who had lain in above a month, felt so violent a pain on a sudden in her right-foot, as made her cry out in a most terrible manner. And yet, after the strictest examination, there did not seem to be any thing amiss; nor was the part affected more than ordinarily hot or cold. The pain however was not abated either by very soft cataplasms, or any other applications whatsoever; and the leg began to swell, and grew inflamed quite up to the ankle. And as the applications were frequently changed in order to lessen the pain, at length she found ease, and slept pretty quietly all the night; and the surgeon, upon hearing that she was easier, did not visit her very early next morning, that he might not disturb her; but when he came at last and opened the leg, he was surpris'd to find the whole foot was cold, insensible, and absolutely mortified, quite up beyond the ankle. He straight concluded upon amputation; and getting all things ready for the operation, returned within two hours, when he found the mortification had spread itself as far as the knee. Terrified with the swift progress of the distemper he declined the operation, as judging it would prove unserviceable; the weakness of his patient's pulse pointing out to him, that she had not

done est: omniaque illa simul serpunt; ulcus in locum pustulosum, pustulæ in eum qui pallet, pallor aut livor in id quod inflammatum est, inflammatio in id quod integrum est, transit. A. Corn. Cels. Medic. lib. v. cap. 26. p. 301.

¹ La Motte *Traité Complet de Chirurg.* Tom. III. p. 358.

not strength to go through it. The next day the sphacelation had got up as high as the middle of her thigh. And in this state her leg was cut off by another surgeon, who was more bold, though not more prudent; for though his patient found no pain from the operation, yet she likewise found no benefit; for she died within two hours after.

§. 431. **T**HIS we shall be able to obtain, 1. By a just consideration of the patient's age, constitution, disease, strength. 2. From the swift progress of the disorder. 3. From being acquainted with the external or internal cause of it. 4. From the season of the year. 5. From the part affected, as it is more or less necessary to life, or as it is of a moist, sinuous, or dry disposition.

In order to form a certain prognostic concerning what is to be hoped for, or what to be feared, the following particulars are to be considered.

1. The age.] In younger persons, where the liquids have the advantage over the solids, there is a general tendency to dissolution in every part; from whence arises frequently a very swift progress of putrefaction, when once it is formed. This is more particularly seen in that gangrene of the gums which goes by the name of the *water-kanker*, and so hastily eats away all around it at this time of life. In a middle age, gangrenes and sphacelations only follow after violent inflammations, or are sometimes observed in acute fevers. In old age, the same disorders arise from mere rest and the failure of the thinner liquids; and in this case they are seldom or never cured, as the cause from whence they proceed cannot be corrected. And may we not rank under this head the *καρκινοὶ ἀκροπαθεῖς*, the *cancers seizing upon the extremities*, which ^a Hippocrates says are incident to old men, and carry them off? It is certain that ^b Celsus has described a resembling disease under

^a Predict. lib. ii. cap. 8. Charter. Tom. VIII. p. 817. cap. 26. n^o 31. p. 301.

^b Lib. v.

under the name of a *cancer*, and said that it was called a *gangrene* (*γανγκραινα*), if formed in the prominent parts, as under the nails, the arm-pits, or in the groin; he adds farther, that old men and persons of an ill habit of body are more subject than others to this distemper. Hippocrates also, in the place we have quoted, soon after subjoins, that the thumbs and great toes are more liable to danger from this cause than any other of the joints.

Constitution.] This is either sound, or diseased. Thus, if a sphacelus be formed in persons of an hot constitution, unless a stop be immediately put to the growing evil by art or nature, it will soon go on to prey upon the adjacent parts. In persons of a cold constitution, *ceteris paribus*, the progress of a gangrene and sphacelus is found to be slower. But if the constitution be affected by a disease, and has a tendency towards putrefaction, as in a putrid scurvy, one species of the *atra bilis*, &c. we have reason to fear the event will prove unhappy.

Disease.] Thus, for instance, a gangrene of the feet after a long dropfy is seldom cured. But when the feverish matter in an acute disease (see §. 423, n^o 2.) falls upon one of the extremities, and causes a mortification there; we have reason to hope, if the other symptoms be favourable, that the patient may escape, with the loss of the part affected.

Strength.] We are to take notice, that in an ardent fever a gangrene and sphacelus follow after a very violent motion of the humours, and in old age after stagnation and rest. In the former case, the progress of the disorder is swifter in proportion to the greater strength of the patient; and, in the latter, we have the less hopes in proportion as the man is weaker. But it is plain at first view, that we have much more to apprehend from extreme weakness, than from too swift a motion of the vital humours through the vessels. For we may diminish the latter by the remedies mentioned in the commentaries on §. 102, 103, 104, 105: but it is much more difficult to restore decreasing strength, especially in very old age; and often absolutely impossible.

2. The progress of an inflammation that will admit of being cured by discussion, is never swift; but all the symptoms either increase by gentle degrees, or scarcely at all: When it tends to suppuration, the pain, heat, redness, &c. come on faster; and the quickest of all, when it terminates in a gangrene; and withal, the danger of the gangrene is proportionally greater the faster it comes on; and so in a sphacelus. This we have confirmed to us by the case mentioned under the preceding Aphorism: For the pain grew insupportable almost from the very beginning: this was followed by a violent inflammation, which was speedily converted into a gangrene; and this changed into a sphacelus, which made large advances in an instant. All skilful surgeons have therefore justly suspected the swift progress of the increasing disorder; and more especially if the gangrene has arisen from internal causes, without any external injury.

3. For by this we know, whether the cause can be taken away or corrected, or not. If, for instance, we should be assured, that a schirrhous tumour so pressed upon the vena cava descendens, as to occasion a gangrene in the lower extremities, (see §. 422, n^o 2.) it would be very evident that the case was incurable; but if the gangrene arose in the parts about the os sacrum and coccygis from the pressure of the body resting long upon them, the progress of the disorder might be prevented by a change of posture, and the part already corrupted be separated from the parts that are sound by proper applications.

4. It is very certain, that a gangrene may be produced by a very sharp cold; and also by an excessive heat, either by the actual application of fire to the body, or by a violent inflammation. That season of the year therefore will be the most favourable, which is neither very cold nor extremely hot; namely, the spring or autumn. But the winter-season is most prejudicial to the gangrenes proceeding from the motionless state of old age; and the summer's heat most noxious when the like disorders follow after violent inflammations or the putrefaction of humours, and more espe-

especially if the constitution of the air be at the same time both hot and moist.

5. Unless a gangrene be cured in the beginning, the part affected will be so far corrupted by the destruction of the solids, and the extravasation and putrefaction of the liquids, that it will be impossible to restore it. If then this part be of such a nature, as to be absolutely necessary to life, it is plain there can be no hopes of safety left; if, for instance, the gangrene seizes upon the cerebellum, the medulla oblongata, the spinal marrow, &c. The difficulty of cure will likewise be increased, if the affection is in any of the moist parts of the body, as the putrefaction will be very much augmented by the continual discharge of humours falling upon it: thus the gangrenes, that arise in the inside of the mouth, which make so swift a progress, and send forth so fetid a smell, are so hard to be removed. But when the place affected is sinuous, as are the genital organs in both sexes, the intestinum rectum, &c. there is always reason to apprehend a difficulty in separating the corrupted from the sound part; and, even when this is done, lest the disorder should afterwards degenerate into a fistulous ulcer. But when the dry and tendinous extremities of the body become gangrened or sphacelated in very old people, or in others who are naturally of a dry constitution, the distemper generally advances by slower degrees, and is not attended with so considerable a putrefaction; but then in this case the separation of the corrupted from the sound parts will be far more difficult, as this can only be done by the application of sound liquids in due force and quantity to the confines of the gangrene.

From what we have already advanced, there may be deduced certain axioms to assist us in forming a just prognostic upon this head, which are contained in the following paragraph.

§. 432. **H**ENCE arise these rules----

From a gangrene comes a sphacelus:

F 2

From:

From a sphacelus the death of the part affected, and the speedy infection of the parts adjoining.

An immediate remedy therefore is to be applied to a gangrene :

And a sphacelus is instantly to be extirpated.

From a gangrene, &c.] As a gangrene is most commonly seated in the panniculus adiposus, (see §. 420.) it usually precedes a sphacelus. For frequently both the muscles, and the periosteum and bones, shall remain sound, underneath the panniculus adiposus, though it be swollen to an enormous size, and actually gangrened. But it is very evident, that a gangrene may from its bulk so press upon the adjoining parts that are sound, or so infect them by spreading, as to bring on a mortification; and then the sphacelus is produced by a gangrene.

From a sphacelus, &c.] So long as there is any remaining circulation of the humours through some parts of the affected member, there is no sphacelus, and still some hopes are left that the corrupted parts may be separated from such as are sound. But when all vital influx and efflux of the humours is absolutely taken away, the part is actually dead. But yet this mortified part adheres to the parts that have life; and often the same causes which produced the sphacelus, continue to act and prey upon the neighbouring parts; nay, though they should even cease from acting, yet the parts which are contiguous will soon be infected. For the liquids will be carried along the vessels till they come to the corrupted place: here they will be every moment in contact with a putrefied substance; and here they will stagnate, as they can no longer obtain a passage through the vessels of the mortified part. In the solid parts, again, the contagion will spread from the continuity of the substance: and how soon the adjoining parts are affected by a sphacelus, has been shewn in the very memorable case which we mentioned in the commentaries on §. 430.

An immediate remedy therefore, &c.] For a gangrene (as Galen has well observed in the passage quoted in the commentaries on §. 419.) holds a kind of middle

middle place between a violent inflammation and a sphacelus; being as much more grievous than an inflammation, as it falls short of a sphacelus: for a sphacelus is the corruption of the entire substance of the affected member; never cured when confirmed; and only capable of being relieved in its earliest stage, when as yet it is not a sphacelus, but a considerable gangrene approaching to a sphacelated state. For as a gangrene has a tendency to the destruction of the part, that is, to a sphacelation, we ought to use our utmost endeavours to administer relief as soon as possible.

And a sphacelus is instantly to be extirpated.] For the adjoining parts, which are sound and have life still remaining in them, are liable to be presently affected by the spreading mischief; so that the longer the extirpation is deferred, the larger portion of the body is lost. And therefore the sad, but only remedy is, To cut off the member which dies by piece-meal, in order to preserve the other part of the body^a. It must be owned, however, that experience has taught us, that nature alone sometimes, which so often suffices to work out her own deliverance, has brought about a cure in such cases, where extirpation seemed to be the only remedy. A man of about forty years of age, of a good constitution, received a wound with a sword on the inside of the lower part of his right-arm about the middle. From this wound there immediately issued a very large discharge of blood, which was stopped with astringents and a strait ligature. A very violent fever ensued, without any sleep; and soon after the whole arm seemed sphacelated up to the elbow. The mortification farther spread quite up to the arm-pit, so that the very bone was bare within four fingers breadth of it, the flesh being putrefied and having fallen off. As the disorder was run so high, the fever and restlessness still continued, the cheeks grew livid, and the pulse was slow and fluttering; the surgeons who were consulted upon the occasion were all of opinion, that it would be to no purpose to attempt an amputation. In the mean time, there comes a woman who undertakes to cure

him; and the surgeons, who had looked upon him as a dying person, very readily gave him up into her hands. Immediately she rubs over the whole part with a certain ointment, covers it up close with linen cloths, and orders him to take nourishing food, and drink a glass of generous wine. After four and twenty hours the limits of the mortified part were plain to be seen: she still pursued the same method; and the case seemed every day to grow better and better, the corrupted parts spontaneously separating. But as there was nothing but corruption from the elbow to the fingers, and the smell was very offensive, the surgeons advised to take away the corrupted part, which could scarce stick to the rest: but this the doctress would by no means allow of, being positive that her ointment would do all that was requisite. At last, after six weeks, the lower part of the arm dropt off of itself from the os humeri: in the mean time she goes on to cover the naked part of the os humeri, and every other part besides, with her ointment; and with so good success, that within a month the naked part of the os humeri separated from the part that was sound, and within four months the cure was finished^b. The ointment she used upon this occasion resembled the Lucatellus's balsam of the shops; and was a composition of oil of olives, wax, turpentine, and red sanders. But that this wonderful cure was not owing to any extraordinary virtue in this ointment, we may learn from another case, wherein it was plain, that nature, unassisted with any remedies, brought about a separation of a sphacelated member^c. A girl of seventeen years of age had a mortification in her leg; and when a surgeon of judgment, out of pure compassion, as she was very poor, would have persuaded her to let him take it off, she absolutely refused, and applied nothing to it but clean linen; and yet the sphacelated member dropt off of itself, by a separation made in the joint of the knee. Several other cases of a like kind are to be met with among the writers of observations, wherein the corrupted parts have of themselves

sepa-

^b Acad. des Sciences, l'an 1702. Mem. p. 270, &c.

^c La Motte Traite complet de chirurgie, Tom. III. p. 365.

separated from the parts which were sound. But it is much more common for the sphacelus to spread; and, unless extirpated, to prove presently mortal. As therefore the sphacelated part is constantly to be taken off, either by a spontaneous separation, or by amputation; and the event is extremely doubtful, if trusted to nature only; the truth of this maxim is sufficiently confirmed, That a sphacelus is instantly to be extirpated. In the mean time these extraordinary cases may let us see, that we ought not absolutely to despair, when either thro' excessive weakness, or for any other reason, the operation cannot be performed: In which the patient's spirits must be kept up by generous food and proper cordials, and such applications made to the part affected as are most likely to prevent or correct putrefaction; and of these we shall treat in the following paragraph.

A gangrene of the brain, viscera, and bladder, is mortal; and, in acute diseases, is the speedy cause of death, tho' the larger parts shall seem scarce injured.

Of the brain.] If we consider the soft and tender substance of the brain, it will appear plain, that if a gangrene be once formed in this part, it will soon be converted into corruption. Nor have we room here for depuration, though the mortified parts should be separated from the sound; as the hard substance of the skull, which surrounds it on every side, would hinder them from being carried off. We have seen indeed, in the account we have given of wounds in the head, indisputable cases, where a considerable part of the brain, especially of the cortical substance, has been sometimes taken away by wounds, funguses, suppuration, &c. and yet the patient has lived, and the brain also has afterwards discharged its proper functions; nay, all the symptoms, which usually arise from the effusion of humours under the bone, pressing upon the brain, have been relieved by an evacuation at the nose and ears. But that a man, whose brain is gangrened, should escape, how many fortunate circumstances must concur, which

which yet seldom any of them happen? For, first, the gangrene must be stopped, and the corrupted part separated from the parts which are sound: then the part which is separated must no longer infect the very tender pulp of the brain to which it is contiguous; and consequently it must immediately force its passage thro' ways, which the industry of anatomists has not yet discovered, though experience seems to teach us that there actually are such, if not in a natural state, at least in diseases: and, lastly, it would be requisite, that all the parts of the substance of the brain which the gangrene had destroyed should be restored. If all these circumstances be thoroughly weighed, I think we shall have little reason to hope for relief, when the brain is once gangrened; and still less, if the cerebellum, or the medulla oblongata, be affected with this disease. Hippocrates has said (see the commentaries on §. 268.) that all persons, who have the brain sphacelated (σφακελισθη), die between the third and seventh day; and that if they get over that period, they recover. But it may well be questioned, whether by this expression he meant the corruption of the brain itself. For in some other places he seems to have described very different diseases under this appellation: Thus he says, *If the brain be sphacelated, a pain seizes the head, and extends quite down the neck towards the spine, the hearing is lost, the head feels cold, an universal swelling supervenes, and of a sudden the speech is gone, blood gushes out of the nostrils, and the complexion turns livid. If the attack be gentle, the hæmorrhage gives relief; but if violent, the man presently dies*^d. It is very plain, that this description does not suit with the corruption of the brain; but the compression of it from a plethora, or the derivation of blood to the head. In another place he has expressed the corruption of the skull under the same name, where

^d Si cerebrum siceratum fuerit, (ην δε σφακελισθη ο εγκεφαλος), dolor caput occupat, et per cervicem ad spinam tendit, et auditus privatio illum prehendit, et frigus in caput irruit, et tumescit totus, et repente voce privatur, et ex naribus sanguis fluit, et lividus evadit. Ille, si morbus leviter corripuerit, quum sanguis exiverit, levatur; si vero vehementer correptus fuerit, cito moritur. *De Morbis, lib. iii. cap. 4. Charter. Tom. VII. p. 583, 584.*

where he says, *A pain comes gradually on in the fore-part of the head; which swells, and looks livid, and is attended with a fever and shivering. In this case it is requisite to make an incision in the part where it swells; and, after cleaning the bone, to scrape it till you come to the diploe; and then cure it as a fracture*^e. From whence it is evident, that the authority of Hippocrates is by no means contrary to the prognostic rule we have here laid down, that a gangrene of the brain is mortal.

On the viscera.] As a gangrene destroys the parts of the body whereon it falls; and, after that, makes frequently very swift advances, unless it be stopt; it is very plain, there can be no hope left, if this disorder once seizes the viscera, especially if they be viscera of a soft substance, such as the liver and spleen; for these will presently turn to putrefaction. But in case the viscera contained within the cavity of the thorax should, after a violent inflammation, chance to be gangrened, death then seems the more certain, as life is oppressed as it were in its very spring. Upon opening the body of his own son, who died of an ischury, Hildanus^f found the kidneys with the adjacent parts to be gangrened. And yet it is certain from undeniable facts, that a gangrene of all the viscera is not absolutely mortal; for if they are of a firmer and membranaceous substance, as the intestines for instance, and the separation of the gangrenous corrupted parts from the parts that are sound be not only possible, but capable of being conveyed out of the body, the patient shall frequently get over it, as we have shewn by several instances in the commentaries on §. 317. where we treated of cases wherein part of the intestinal tube was carried off by a wound, suppuration, or gangrene. In those viscera therefore, which are of a firmer contexture, and not so liable to putrefaction, a gangrene seems to be attended indeed with the utmost danger, but is not always certainly mortal.

^e Dolor paulatim anteriorem maxime capitis partem detinet, et intumescit, et livefcit, et febris ac rigor prendit. Quum sic habuerit, fecerare oportet, qua parte tumuerit; et os perpuratum radere, donec ad diploen perventum sit; deinde ut fracturam curare. *De Morbis, lib. i. cap. 8. ibid. p. 559.*

^f De Gangræna et Sphacelo, cap. 4. p. 774.

mortal. And this doctrine Hippocrates appears to have advanced in the place where he discourses of the inflammation of the lungs. For when the lungs are greatly inflamed, he observes that they fall to the sides, and shall then look livid externally, and that the ancients gave the name of βανός to persons that were thus affected. But the livid hue is a sign of a gangrene, as we have shewn on §. 427, n^o 3. He then subjoins in the next prænotion, *But in case the whole lungs shall be inflamed, together with the heart, and in such a manner as to fall upon the side; the patient then loses the use of all his limbs, lies cold and senseless, and dies on the second or third day. However, if the limbs only are inflamed without the heart, and the attack of the disorder is less severe, the patient shall lie a longer time, and even some will get over it^g; for the corrupted matter may be expectorated by spitting. But if the heart itself be gangrened, what grounds can be left for hope? Now that such corrupted matter may be sometimes thrown up out of the lungs, we learn from certain experience. Dr Bennet has^h observed a dirty kind of spittle, not much unlike a liquid clay, to be cast up by people in a deep consumption; and, upon opening their bodies, has found the lungs converted into a dreggy filth, which plainly pointed out the certainty of the mortification. This kind of discharge has likewise been sometimes observed, even when the patient has recovered, the gangrened and corrupted part being separated from the sound parts wherein there was life, and thus coughed up. At least this seems to have been the opinion of Hippocrates in the following passage: *A suppression of cough in a fever, says he, is a bad symptom, if what is discharged be livid, black, or bilious; but to have the expectoration free, is a circumstance of advantage*ⁱ. And to the same purpose*

^g Quibus vero totus pulmo inflammatus fuerit cum corde, sic ut ad latus procidat, resolvitur totus æger, et jacet frigidus, sine sensu, et moritur secundo aut tertio die; si vero sine corde contigerit, et minus, longiori tempore vivunt: quidam autem etiam servantur. *Coac. Prænot. n^o 401, 402. Charter. Tom. VIII. p. 875.*

^h Theat. Tabidor. p. 68.

ⁱ Sputi excreationes in febre lividæ, nigræ, biliosæ, siquidem supprimantur, malum; secedentes vero pro ratione, utile. *Coac. Prænot. n^o 243. Charter. Tom. VIII. p. 65.*

purpose he says in his aphorisms, *In fevers which are not intermittent, the discharge of a livid, bloody, fetid, bilious matter, by coughing, is a bad symptom; and yet if it comes up easy, it is a good sign^k, &c.* The following part of the aphorism, and Galen's comment upon it, inform us, that this discharge goes on well, when the patient can bear it with ease, and finds himself relieved by it. It may perhaps seem a vain confidence to hope for a recovery, where the lungs are actually gangrened; and yet it can certainly never be of disservice to the patient, to find, that, how bad soever his case may be, his physician does not absolutely despair of giving him some relief.

Of the bladder.] If after violent inflammations, or any remarkable hurt of the bladder by wounds, dilacerations in drawing out a stone, &c. a gangrene follows, the event is always very bad; partly from the sharpness of the urine, which as it is continually falling upon the part thus affected must increase the putrefaction already formed; and partly from the large quantity of nerves dispersed over the bladder, by which means this circumstance cannot but greatly affect the brain and the whole nervous system. Celsus observes, That if the bladder be wounded, the stomach is affected; and that bilious vomitings, hiccoughs, coldness, and death itself, are the consequences following upon it^l. And in another place he says, That, in the extraction of the stone, the patient is in danger of suffering by the distention of the nerves, from the agitation of his bladder^m. Hippocrates hasⁿ pronounced a pain and hardness (that is, an inflammation) in the bladder to be dangerous and destructive, but more especially so if joined with a fever; and then he takes notice, that the patient generally dies in the first stage of the distemper. Celsus^o also writes, that a cancer (under which appellation we have shewn in the common-

^k Excreationes in febribus non intermittentibus lividæ, et cruentæ, et graveolentes, et biliosæ, omnes malæ; bene tamen si prodeant, bonæ, &c. *Seft. iv. Aphor. 47. Charter. Tom. IX. p. 165.*

^l Celsi lib. v. cap. 26. n^o 19. p. 288. ^m Lib. vii. cap. 26. n^o 5. p. 482.

ⁿ Prognost. Charter. Tom. VIII. p. 659. et in Coac. Prænot. n^o 471. ^o Lib. vii. cap. 27. p. 489.

mentaries on §. 419. he has treated of a gangrene) will sometimes follow upon a wound in the bladder, and that the signs of it are, *si et per vulnus, et per ipsum colem, fluit sanies mali odoris, cumque ea quædam a concreto sanguine non abhorrentia, tenuesque carunculae lanulis similes, &c.* “ if a fetid sanious matter be discharged from the wound, and also be voided by the penis, with certain substances not unlike clotted blood, and little pieces of flesh resembling bits of wool, &c.” And though he does not seem absolutely to have despaired of a cure, yet he ^p takes notice, *orto cancro sæpe affici stomachum, cui cum vesica quoddam consortium est; exque eo fieri, ut neque retineatur cibus, neque, si quis retentus est, concoquatur, neque corpus alatur: ideoquo ne vulnus quidem aut purgari, aut ali posse, quæ necessario mortem maturant:* “ That when the cancer is formed, the stomach is affected, which has a kind of agreement with the bladder; and from hence it happens, that it can neither retain the food, nor concoct it when retained, and of course that the body cannot be nourished; for which reason neither can the wound be cleansed, nor due nourishment be conveyed to it; all which must of necessity hasten death.”

Now if, in an acute disease, the humours, either grown unpassable from their inflammatory density, or adhering by error of place in vessels which do not belong to them, shall so obstruct the very tender vessels of the brain, whereon life and humanity depend, as to take away all vital influx and efflux, the consequence will be sudden death; nor can scarce any sensible defect be possibly discovered, as the parts are too small to fall under the notice of the senses. Neither is it a matter of importance, whether the distemper first seized on these parts, or the inflammation originally began in other parts of the body and was translated to the brain. For which reason Hippocrates has been so exceeding careful to set down all the symptoms by which an approaching delirium might be prediscerned, that the mischief might be guarded against before it happened

pened, which when once it prevails is so apt to carry certain destruction along with it. Thus I have observed a pain in the thigh, in a continual fever; which has presently passed off, and a phrenitis has suddenly succeeded, which has carried off the patient in three days. And this we have confirmed by resembling cases in Hippocrates. Calvius, ⁹ (says he), at Larissa, was suddenly seized with a pain in his right thigh, which was not relieved by any of the applications made to it. On the first day he had a slight acute fever, but attended with pain. On the second day his pains grew less, but his fever was very high; he was very fretful (*υπεδυστορει*), got no sleep, had a coldness in the extreme parts, and made a large quantity of crude water. On the third day the pain of his thigh left him; but he grew delirious, and very restless. On the fourth day, about noon, he died suddenly. We have observed in the commentaries on §. 423, n^o 2. that the matter of a fever shall sometimes be deposited on the extreme parts of the body, and there very speedily corrupt not only the soft parts, but also the very bones; and the same circumstance has sometimes been observed in the plague, as we there shewed. If now a resembling matter fall upon the brain, the lungs, the heart, and the viscera, it is plain that death must soon be the consequence.

A gangrene in the inside of the mouth, of the lips, nose, and genital organs, is hard to be cured.

We learn from anatomy, that the skin terminates near the lips; and that the lips, the inside of the cheeks, and the other parts of the mouth and jaws, are covered only with the epidermis or scarf-skin. If therefore an inflammation arises in these parts, which cannot be discussed, it is seldom that we obtain a laudable suppuration, but instead of it have almost constantly a corroding gangrene. For the parts being exposed to the air, and continually watered with the saliva, which is frequently sharp, are easily converted into a fetid viscidous humour; and as there is then for the most part more than ordinary flux of the salival juice, and this

disease (if not presently stopt) is apt to eat into the adjacent parts, it has obtained the name of the *water-hanker*. This distemper is very common in the Low-Countries, and sometimes rages like an epidemical distemper, and affects many at the same time, especially such as are of a scorbutic habit; as we have already observed in the commentaries on §. 423, n^o 2. There first arises on the inside of the cheeks, gums, lips, tongue, tonsils, &c. a slight redness not very painful, and a more than ordinary heat; soon after, a white spot shews itself in the middle of the red part, which the surgeons are sometimes apt to mistake for the first appearance of a suppuration. The pain then increases, and particularly in the place where the white spot is; as also in all the parts around it, which at this time look very red. In the mean while the exulceration sinks deeper, till the whole white spot, which is nothing else but a true gangrenous eschar, falls off; as it will do if the distemper be not severe, and the patient be a person grown up. But if the case be very malignant, and the person affected be young, the mischief spreads, and the white spot enlarges itself to a considerable extent: at the same time the breath smells very offensively, and a large discharge of very fetid saliva is continually distilling from the mouth; so that, unless a very speedy and effectual remedy be directly applied, no part that lies near it can escape being corroded by it.

I have seen very terrible instances of this kind, and which I cannot think of without horror, in the children of poor people, where the case has either been neglected in the beginning, or ill-treated. For the gangrene of the gums has not only spread so far as to destroy the teeth which have already shewn themselves, but has also so corrupted the rudiments of the future teeth within the sockets, that the poor wretches have from their infancy been obliged to undergo the inconveniencies of age, and become toothless. And yet this is but a slight part of their sufferings; for I have seen where the gums have been so corrupted, that almost the whole bone of the lower-jaw has been cast off, the tongue eroded, the lips, cheeks, and chin, almost entirely

entirely eaten away, till death has at last put an end to their distress. And so great a stench does frequently attend this distemper, that, when the disease is come to its height, there is no bearing it. I was once called in to a corpulent man, in one of the worst kinds of a putrid scurvy, whose lower jaw was almost entirely eaten away with this disease; and setting myself down by him, as not knowing his distemper, when he turned himself to speak to me, he sent out such a deal of stinking breath, that I was almost ready to sink in my chair, and could not keep myself from very troublesome reachings all the day after. As this disorder frequently arises from the scurvy, it is usual to wash the mouth often with spirit of scurvy-grass, treacle, and such like medicines; but these are almost always disserviceable. If the case be slight, and in its earliest stage, (which is known by the redness, heat, and pain, and no fetid smell), sal-ammoniac, or nitre, diluted with a large quantity of water, adding to it a little vinegar or lemon-juice, will be very beneficial, whether used as gargle, or by dipping soft linen rags in it and gently applying them to the part affected. It is a wrong custom, which has got among the surgeons, to dip a sponge in a mixture of this kind and rub it roughly against the part; for this is constantly prejudicial, both as it increases the pain, and destroys the tender parts. But in case the disease begins to spread, and the parts grow fetid, these remedies will prove insufficient, and we must endeavour to subdue the putrefaction with spirit of sea-salt. Twenty drops of this spirit must be mixed with half an ounce of honey of roses, and the part affected gently rubbed over with this medicine several times in a day; and if the putrefaction be very great, the quantity of spirit of sea-salt must be increased: in very bad cases, I have even used the spirit of sea-salt alone, without any other mixture, and always with good success; for it has presently stopped the progress of the gangrene, and soon after the gangrenous eschar has separated from the parts wherein there was life. Nor have I ever known this application to fail me, except where, the gums being entirely putre-

fied, the jaw-bone has been affected, for then I could not prevent its being carious; but if the soft parts only in the inside of the mouth are gangrened, it will certainly cure them.

When this disorder lies in the lips, we have still something farther to fear. For when the integument which covers the soft substance of the lips is eroded, the nervous papillæ are often expanded to an immense bulk when freed from this confinement, and degenerate into a very bad fungous cancer. Or if the membrane, which lines the inside of the nostrils, be corrupted, the bones will be laid bare; and as they are very tender, they will not admit of an exfoliation, but constantly grow carious and fall. If a gangrene therefore seizes upon these parts, it must be evidently very difficult to cure.

Of the genital organs.] For these cellular places have a wonderful structure; and lying near the two emunctories (the alvus and the bladder) whose office it is to carry off the filth from the body, they emit a kind of putrid smell even in a sound state: so that if a gangrene be formed here, it both spreads very fast and is hard to be cured. Hildanus^r ingenuously owns, that of almost an infinite number of persons whom he had seen with a gangrene in the scrotum, he never knew one recover: So that he stood amazed at a cure of this kind, which was communicated to him by an eminent physician, as a prodigy in the art. I remember, about seven years ago, to have seen an extraordinary case of such a gangrene myself. A man of forty, of a good constitution, healthy and robust, was seized with a slight strangury, without any apparent cause; and as he had formerly found relief in a resembling case from the terebinthinated balsam of sulphur, he had recourse to it again; and yet, though he several times repeated it, he found no benefit. About two days after taking an emollient decoction, he found his disorder less: though the day following it again grew very bad; and at the same time he began to feel a pain in the perinæum, and a surprising tremor both in the scrotum and

and penis: he then grew feverish, and made a water which deposited plentifully a thick, mucous sediment, and still retained the smell of the balsam of sulphur that he had taken four days before. Upon this an emollient fomentation was outwardly applied; he was let blood; and took some cooling purges, &c.: but without any great advantage; for with all his endeavours he could only make a few drops of a very fetid water with great difficulty, insomuch that on the seventh day from the first coming on of the disorder the scrotum was swollen to a monstrous size, as also one side of the spongy substance of the penis. The next day the scrotum, being gangrened, burst; and discharged a bloody sanious matter: the affected side of the penis seemed also to be entirely gangrened. Upon this, fomentations and cataplasms were applied of rue, water-germander, hore-hound, sal-ammoniac, &c. mixed with vinegar; the part was deeply scarified; and, as the putrefaction was terrible, an application of spirit of sea-salt diluted with six times the quantity of water was made to the gangrened parts; by which means the mortification was stopped, and the mischief kept from spreading farther. But yet as the patient was exceedingly restless, was subject to continual reachings, had a quick low pulse, and the urine and sanious matter were constantly lying upon the parts affected, there seemed to be but small hopes of relief; though the uniform temper of his body quite down to the extremities, and his naturally strong constitution, made me not absolutely despair. However, I could by no means prevail upon him to submit to what I judged most likely to do him service, as he looked upon his death as certain; and indeed greatly desired it, as the only remedy which could put an end to his sufferings. The people about him gave him, notwithstanding, some drops of the dulcified spirit of sea-salt in his common drink, without his knowledge; and, after much intreaty, he consented to let the surgeon scarify as deep as he pleased in the gangrenous parts, which he then covered with linen cloths dipped in a mixture of spirit of sea-salt with six times the quantity of water, laying

over all an antiseptic cataplasm. Thus was the gangrene hindered from going farther; and on the fourteenth day a small fissure began to shew itself along the side of the penis, which separated the mortified part from the parts that were sound, and within three days the like appearance of a beginning separation was discernible in the groin. The patient then began to have some hopes that he might recover, and very readily took down the medicines prescribed for him: his appetite returned, and his spirits were recruited with his food; so that, within eight days after, all the corrupted gangrenous part was cast off in such manner, that no part of the scrotum was left remaining, and the muscoli suspensorii of the testes were to be seen uncovered. The urethra in two places, the one near the bulb, and the other about a finger's breadth from the glans, had lost so much of its substance, that he could never after make water through the aperture of the glans, but constantly discharged it in the perinæum; and though we endeavoured, by inserting a silver tube, which we left in the urethra for several nights and days, to draw together the extremities of the urethra where it was divided, and by the application of very smooth balsams to lengthen the vessels so as to bring them over to the part that was lost, we were never able so to effect it, but that still the opening remained, and the urine ever after passed through a hole in the perinæum, and still will pass so long as the man shall live; for he is still alive, and in other respects enjoys a very good state of health. We have a like instance of the cure of a gangrene in the scrotum, in the Observations of ^rStalpart van der Wiel; who has also taken notice, that afterwards something of a fleshy substance grew downwards from the cutis and fleshy membrane of the abdomen, which by degrees covered the testicles; but in such manner, that this new scrotum was quite smooth and without folds, and at the same time so closely pent up the testicles, as to keep them fixed and unmoveable in one situation. Something of this kind also happened in the case I have been relating.

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The genital parts of women are sometimes so bruised and lacerated in a difficult birth, that a gangrene shall follow, which is always difficult to be cured, though not absolutely incurable. Several cases of this kind are to be met with among the writers of observations, but one from ^s Ruysch will suffice for our purpose. A woman, after a difficult birth, had so terrible a gangrene of the pudendum and intestinum rectum, that many persons imagined she could not long hold out. She escaped however, and was perfectly cured; tho' after the separation of the corrupted part there was found an opening in the vagina, which penetrated into the intestinum rectum, big enough to transmit a walnut with the rind on, through which the fæces passed freely into the vulva. And this author tells us in the same place, that he had cured several other women in the like case.

A sphacelus of the extreme parts, and of tendinous parts, is mortal in old people.

It was shewn in the commentaries on §. 424. and is confirmed by observations in practice, that such kind of gangrenes in old age for the most part arise from causes which admit of no cure. For they are generally owing either to too great a stiffness in the vessels, or to the want of strength in the heart. And therefore scarce any separation of the corrupted part can here be expected, as it depends upon the proper conveyance of sound humours by vessels which have a just degree of flexibility. Nor will the amputation of the affected part be of any service, as the same disorder will return in the parts above, from the same causes, as was seen in the remarkable case that was here recited. All that art can do under such circumstances, is, to preserve the part by such applications as would even keep off putrefaction in a dead carcase; by which method, the spreading of a mortification may be stopt for whole months together in persons extremely old, and who already are properly dead in some particular part. For most commonly a purple or livid spot in this case first shews itself in the toe; which, if care be not thus taken, soon
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after spreads, and brings on a fatal sphacelation. Nor do I recollect that a gangrene coming of itself in the toe of a very old person was ever known to be cured. And yet in an old man of seventy, but a very hearty one, who had such a gangrene on the inside of the ankle of his right-leg, I saw the mortified part cast off, and a perfect cure wrought, by a constant fomentation of it with an infusion of rue fresh-gathered in vinegar and wine, and the addition of a proper quantity of salt.

A gangrene in hydropical, consumptive, scorbutical people is of very bad consequence, and the messenger of death.

A gangrene is produced in hydropical people, either because the water that is collected, by pressing upon the parts, extinguishes all motion in them; or because, when it is grown putrid and sharp, it erodes the parts that are contiguous: in both which cases there are no grounds for hope. For if the waters remain, the disorder will be increased, as the same causes which produced the gangrene will still continue to act: And if by any means they be drawn off, the parts being grown flaccid, and well nigh tabid, and no longer sustained by the uniform pressure of the fluid wherein they were steeped, will run together, the vessels will burst, and the death both of the part affected, and of the whole corporeal system, will be accelerated.

In consumptive people also, who already labour under an atrophy from a purulent state of the blood, and which commonly ends in a very putrid diarrhoea that carries them off, it is very plain there can be no hope of a recovery if once a gangrene seizes upon any part of the body. For the vital strength is continually decreasing, and the nature of all the humours daily growing more acrimonious; so that neither the separation of what is corrupted, nor the restoration of what is left, can here be possibly obtained.

And in scorbutic persons (as we have already observed in the commentaries on §. 423, n^o 2.) the cohesion of the vessels is lessened to such a degree, as to occasion

a rupture by every slight violence offered to them; at the same time the humours are very acrimonious, and in a bad case of the scurvy there is farther an universal tendency to putrefaction. (See §. 1151. n^o 3, 4.) As therefore the acrimony of the humours, the rupture of the vessels, and the putrefaction of the extravasated humours, are all capable of producing a gangrene (see the commentaries on §. 388), the cure of this disorder will be extremely difficult in a scorbutic habit. For which reason it is that the ulcers of the legs, which are so usual in the scurvy, are almost constantly attended with gangrenous incrustations, which if carried off by detergent applications shall immediately grow again, inso-much that these ulcers can scarce ever be brought to cicatrize in due manner.

A sphacelus mounting upwards, and causing watchfulness, deliriums, faintings, belchings, hiccoughs, convulsions, pains, cold sweats, and drowsiness, is the fore-runner of death.

Here are recited, and in the very order in which they proceed, the several symptoms which usually attend a mortal sphacelation. For if the sphacelation be stopped, either spontaneously, or by art, there arises a separation between the part wherein there still is life, and the part that is mortified; nor, after this mark of separation, does the disorder ever make any farther advances. But in case it spreads, it is then said to mount upwards: because, if it begins in the great toe, it ascends by seizing first the foot, then the leg, and last of all the thigh; or if it begins in the fingers, it usually runs along the whole length of the arm, quite up to the armpit, before it kills. But the functions of the brain are constantly found to be disordered, if the sphacelus becomes mortal; and then also the vital functions begin to be affected, till at last the patient falls into a quiet sleep, and in that situation dies. It is therefore one of the worst symptoms in a gangrene or sphacelus that has seized upon the extreme parts of the body, to have any signs of a disordered brain. Whence Hippocrates: *Every grievous sphacelation is dangerous; but if there*
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be any bilious vomiting, attended with restlessness, or heaviness of the eyes, or loss of voice, or an unwillingness to speak, or any disposition to rave, these are certain symptoms of death and convulsion^t. But watchfulness, as we shall shew hereafter when we come to treat of a phrenitis and the symptoms of a fever, is almost always the first sign to raise the attention of a physician to use his utmost efforts in diverting the force of a disease from the head: this is followed by a delirium; and then the cerebellum being affected, a syncope ensues: in consequence of which, come belchings and hiccoughs, from the irregular motion of the spirits through the nerves of the abdominal viscera: next succeed convulsions and pains; and then the viscid cold sweat, which gathers in drops upon the skin, and is the most certain sign of approaching death, concerning which Helmont has oddly expressed himself in the following words^u, *quod non sit tam latex in sua natura, quantum ros alimentarius resolutus, cui mors imperat*. At last they sink into a gentle sleep, and in this state die. Now as a sphacelation arises from several causes, so also do these symptoms come on in a swifter or slower degree. If this disorder proceeds merely from the motionless state of old age, it creeps slowly; and may sometimes hold out for several months before it destroys, provided that the part affected be well fomented with such medicaments as have the power to prevent putrefaction. But if a gangrene follows a violent inflammation in the flower of youth, and to this a sphacelation succeeds, it presently mounts upwards, and often in a few hours becomes incurable, as we have shewn by several instances already produced. Many of these symptoms, which attend a sphacelation when it proves mortal, are likewise to be seen in Celsus. For after having described the manner in which a gangrene spreads, he adds as follows: *In the mean time there comes on an acute fever, and great thirst: some*

^t Sphacelus autem gravis, periculosus; si autem vomitus biliosus cum anxietate, aut oculorum stupor, aut vocis privatio, aut rarus sermo, aut deliratio quædam, lethalia hæc & convulsiva. *Epidem. vii. textu 71. Charter. Tom. IX. p. 578.*

^u In capit. *Latex humor neglectus*, n^o 17. p. 303.

Some also grow delirious ; and others, though their senses are not quite gone, are scarce able to get out their words, so as to make themselves understood : the stomach begins to be affected, and the breath itself smells fetid. If this disorder be taken in its first attack, it will admit of a remedy ; but if once it comes to be deeply rooted, it is incurable. Those who are afflicted with it, for the most part die in cold sweats.*

A lividness, blackness, dryness, and round ulcers, indicate an approaching gangrene, sphacelation, and death.

Hippocrates in his ^v prognostics, where he so carefully reckons up the several particulars which a physician should attend to in order to form a right judgment concerning the events of diseases, sets down also the following remark : *It will be proper also to consider, whether the patient had an ulcer before his distemper, or whether it came during the distemper. For if he is to die, the ulcer before his death will look livid and dry, or pale and dry*^y. Now in the commentaries on §. 158, no 7. and §. 403, no 1. where mention was made of this prognostic, we shewed, that laudable pus was formed from the surviving vital power, and the humours conveyed to the wound or ulcer ; that is, if proper liquids were conveyed thither with a due impetus and in a just quantity : but if otherwise, that a different liquid would be discernible in the wound, of an improper nature for the formation of good matter ; for which reason it was, that, in an ill habit of body, the forming of good matter, and the consolidation of wounds or ulcers, were found so difficult. But when, thro' the defect either of the vessels, of the humours, or of both, there is no liquid conveyed

* Inter hæc deinde febris acuta oritur, ingensque sitis: quibusdam etiam delirium accedit; alii, quamvis mentis suæ compotes sunt, balbutiendo vix sensus suos explicant; incipit affici stomachus; fit fædi spiritus ipse odor. Atque initium quidem ejus mali recipit curationem; ubi vero penitus insedit, insanabile est. Plurimique sub frigido sudore moriuntur. *Lib. v. cap. 26. n° 31. p. 301.*

^y Considerare autem oportet, an forte æger ulcus habuerit ante mortem, an vero in ipso morbo natum. Si enim homo moriturus sit, ante mortem lividum et siccum erit, vel pallidum et siccum. *Hipp. Prognost. textu 22. Charter. Tom. VIII. p. 605.*

veyed to the wound, the surface of the wound will be dried by the air and heat of the neighbouring parts, and the whole that shall thus be dried must be afterwards cast off before the cure can be completed. The dryness therefore of the wound denotes a failure of the vital influx and efflux of the humours in the affected part; but the lividness and blackness indicate that a true mortification is already begun, and therefore are deservedly considered as the worst symptoms which can happen in any disease.

§. 433. **T**HE curative indications in a gangrene are, 1. To corroborate or maintain the vital powers. 2. To prevent the absorption or return of the putrid matter into the veins. 3. To expel and correct the putrefaction already formed in the juices.

Having considered what is necessary to be observed with regard to the diagnosis and prognosis of a gangrene, we are next to treat of the curative indications, which direct the manner how, and the means by which, the cure is to be performed. But that we may meet with no confusion in these considerations, it will be necessary for us to recollect what was said in the commentaries on §. 419. namely, that it is difficult to distinguish betwixt the limits of an incipient gangrene and a phlegmon. Since therefore a gangrene is in its beginning nearly related to a phlegmon, from which it nevertheless highly differs when it passes into a sphacelus; it is evident, that there must be various degrees of malignity in a gangrene during that intermediate space of time, and that a various method of treatment will be accordingly necessary. For an incipient gangrene may be sometimes removed by a happy correction or alteration only of the parts, as we shall shew at §. 441. But when the disorder is confirmed, the corrupted parts cannot be restored to their former healthy state, but the dead parts must be separated from the living to which they adhere. In this place therefore we are

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only to reduce the curative indications to their general heads, and consider them more particularly hereafter.

1.] So long as the healthy humours have a free motion through sound vessels with a due impetus and velocity, the parts have their health and actions entire: but when this equable motion of the humours is destroyed or impeded, either throughout the whole or in some particular part of the body, the powers or actions of the whole body or of the affected parts are then weakened or abolished; and from hence follow those spontaneous lassitudes which render people incapable of following their usual labour without great uneasiness, and which Hippocrates ^a pronounces to be the forerunner of diseases, notwithstanding they seem to be in other respects in good health. For we frequently observe these lassitudes, when the blood is by an inflammatory spissitude rendered less pervious, or incapable of passing freely through the smallest vessels. The vital powers will be therefore maintained or corroborated by every thing which promotes the free circulation of the humours through the vessels, and removes the impediment or obstacles which diminished or disturbed the same; and therefore different remedies are to be used for keeping up the vital powers, according to the different causes and circumstances of the disorder, as we shall explain in the following aphorism.

2.] The urine naturally washes out those particles of our humours which incline to a state of putrefaction, and which would be extremely injurious to the small vessels if they were any longer retained so as to circulate with the other humours thro' the vessels: but when the secretion and excretion of the urine is perfectly suppressed by an ischuria, these retained excrementitious parts of our humours becoming more acrid and putrid, seem to exert their injurious action most upon the very tender vessels of the encephalon; and the patient who is thus afflicted with an ischuria expires also oppressed with a deep sleep or insensibility, in the same manner as those who die of a sphacelus, after nearly the like symptoms have also preceded in both cases. There is

VOL. IV. H there.

^a Aphor. 5. sect. 2. Charter. Tom. IX. p. 46.

therefore just reason to fear lest the putrefaction of the humours which follow a gangrene should produce the same injuries by being absorbed and returned into the blood by the contiguous veins; to prevent which, therefore, we are to use our best endeavours.

3.] Every part of our bodies which is deprived of the vital influx and efflux of its humours which it before enjoyed, spontaneously degenerates into a state of putrefaction; and therefore it is required of us to prevent the future, and to correct or discharge the present putrefaction, that it may not infect those parts which are as yet sound. When the affected part is accessible to the hand, such remedies may be applied as may be very reasonably expected to produce this effect; but if the disorder lies concealed in the deeper parts of the body, it is evident that to do this will be very difficult.

§. 434. **T**HE vital powers are secured or maintained, 1. By the use of every thing which can weaken and oppose the internal causes of the disorder (422 to 426), and which may excite the spirits and preserve the free circulation of the juices; having at the same time a regard to the age, sex, and constitution of the patient, with the season of the year; and therefore these remedies are to be taken, as well from the class of coolers, as of those which heat, according to particular circumstances. 2. By the use of such solid and fluid aliments as are analeptic or restorative. 3. By epithems upon toasted bread, and such things as are directed by n^o 1. of this aphorism, applied to the veins, or drawn in by the nose and mouth in the form of vapours.

1.] When this indication is to be answered, a regard must be had to the nature of the causes which produced the gangrene; all which causes were enumerated and reduced to their proper distinct classes under the aphorisms

aphorisms here cited. Thus, for instance, if a putrid scurvy of the worst kind should have infected the blood and juices with ill conditions, in that case every thing which opposes this putrid acrimony of the juices will conduce to corroborate the vital power; such as Rhenish wine, with the juice of citrons, oranges, &c. which are of the greatest use in this case. But for poor people, order milk that has been deprived of its cream, or whey boiled with a little mace or nutmegs. But as every gangrene, from whatever cause proceeding, constantly inclines the parts to a state of putrefaction, it is evident that the use of the forementioned acids ought to be constant and general.

Excite the spirits.] It appears from the most certain observations, that there are some things in nature which have a considerable efficacy or influence upon those most subtile humours in our bodies which we call the spirits, insomuch that they are capable of producing various disturbances throughout the whole body. In the mean time all the force of such remedies depends upon their minute corpuscles or effluvia, so subtile as to escape not only the senses, but even the imagination also. Thus for instance, assafætida does, by its strong smell only, very happily allay those inordinate motions of the spirits which are produced in hysterical women; and yet, after it has filled a whole chamber with its effluvia for several months together, it does not appear to have received any considerable diminution in its bulk. But the fragrancy of musk, on the contrary, very often has the worst effects upon those women who have very weak nerves, throwing them sometimes into dreadful convulsions; and yet the musk itself does not suffer any sensible loss in its weight, even though it be kept for many years, and infects all the adjacent bodies with its indelible smell. The *Materia Medica* furnisheth us with several known remedies, the vapours or exhalations of which alone are sufficient to excite the spirits, and inspire as it were new life into the weakest patient. If a weak girl is about to faint, and a pomelitron be applied to her nose, she presently revives; and the same thing also happens from the effluvia of

vinegar, and of almost all the agreeable spices. Now all those things which excite the spirits are more especially useful in a gangrene or mortification; because nothing weakens more, nor exhausts the strength sooner, in the strongest person, than putrid effluvia. If the healthiest man should, in the summer-time, by accident happen to meet with the carcase of a drowned animal, upon the bursting of its abdomen such an intolerable exhalation is discharged, that, being taken in with the breath, it causes the man to faint away, and to be troubled the following part of the day with sickness and reachings to vomit. When putrid bile is lodged in the stomach, or near the præcordia, it occasions the most extreme weakness; which bile being carried off by a vomit, the patient recovers his strength. Since therefore there is always danger, in a gangrene, of a putrefaction, it is evident why those fragrant spices ought to be so frequently used, more especially mixed with vinegar. In Hildanus^b and other writers, we meet with high recommendations of bezoar, pearl, the bone of a stag's heart, and the like: but Rhenish wine, mixed with juice and peel of a citron, with a little cinnamon or nutmeg, &c. is in these cases much more efficacious; and if a violent fever or intense heat of the body forbids the use of the warmer cordials, we may make a very safe and at the same time a cooling cordial of elder-flowers, roses, &c. mixed with vinegar.

As preserve the circulation of the juices.] Since a gangrene is such a state of the soft parts as inclines them to mortification by destroying the vital influx and efflux of their juices, every endeavour must be used to preserve the motion of the humours through the vessels, and prevent their stagnation. Now the circulation of the humours is impeded either by a defect of the humours themselves to be transmitted, or by a fault in the transmitting vessels, or by a defect of the moving powers. Every thing therefore which dilutes and attenuates the juices, opens the vessels, and excites the moving powers by a gentle stimulus, are very well adapted to this disorder. Hence the decoctions of grass,

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^b De Gangræna et Sphacelo, cap. 12. p. 786.

roots of burdoc, viper's-grass, as also the five opening roots, with the wood sanders, saffraſas, &c. are extremely convenient by the way of infuſion; becauſe they dilute and diſſolve, while at the ſame time they excite the humours with a gentle aromatic ſtimulus, ſo as to anſwer all theſe indications.

Having at the ſame time regard to the patient's age, &c.] For very different things are required in a decrepid old perſon, whoſe forces are all languid, and whoſe blood or juices are of a cold, phlegmatic, or mucous diſpoſition, from what are requiſite in a ſtrong young man of a warm habit. The bodies of women are in general more lax than thoſe of men, and very eaſily alterable by the ſlighteſt cauſes; and yet they more eaſily ſuſtain the greateſt and moſt ſudden alterations. This is evident from their menſes, child-bearing, lying-in, and evacuations of the lochia, and of blood from the uterus frequently in exceſſive quantities: whence it is apparent that a regard muſt be had to the difference of ſex in the patient; as alſo to the habit or conſtitution, as being either hot and bilious, or cold and watery. The ſame may be alſo ſaid with reſpect to the ſeaſon of the year: for in the ſummer-heats, eſpecially when the air is moiſt, every thing tends to a ſtate of putrefaction; whereas, in the winter's cold, all things keep a long time without corrupting. See what has been ſaid in this reſpect in the comment on §. 193.

Theſe are therefore to be choſen from the claſs of coolers, &c.] In the firſt place, inquiry muſt be made whether or not the ſtrength is deficient; and if the pulſe appears to be ſtrong, large, and in ſome degree ſenſe or hard, with a conſiderable degree of heat, continued even to the extremities of the body, and if the urine appears high coloured or red, we then know that the powers of the circulation are ſufficiently ſtrong, and that therefore they ought not to be increaſed: but if the pulſe is weak, and attended with ſigns oppoſite to the former, we may then conclude that it will be neceſſary to excite the vital powers. In the next place, inquiry muſt be made whether the juices incline to a putrid or any other acrimony; or whether a cold,

phlegmatic, or mucous disposition of the juices is predominant; which last may be known from the signs mentioned in treating of the spontaneous glutinosity and alkaline state of the humours in the beginning of these aphorisms: In the first case, pleasant stimulating acids are to be exhibited; and in the latter case volatile salts, elixir proprietatis, &c. are proper, various forms of which may be seen in the *Materia Medica* corresponding to this aphorism.

2.] Those are said to be upon the recovery, who gain strength after they have been afflicted with some violent disease; and although health returns as a consequence of nature's overcoming the disease, yet it is necessary for such patients to be supplied with good nourishment, to repair the loss which they have sustained by the preceding disease. But the patient's weakness requires that he be supplied with such solid and fluid aliments as abound with nutritious matter, whereby the decayed parts may be renewed by virtue of the chylicative and sanguificative organs; and at the same time those aliments should be such as to require little or no action of the vessels and viscera to assimilate them into healthy juices. Solid and fluid aliments of this nature are said to be *analeptic* or *restorative*; concerning which, see what has been said in the commentaries on §. 28, n^o 12. Now, in the choice of these, a regard must be had to the age, sex, custom, &c. of the patient, as we observed before under the preceding number of this aphorism. And as there is almost constantly danger of a putrefaction in a gangrene, acescent aliments are therefore to be used, such as milk, decoctions of bread, oats, barley, &c. with veal-broth mixed with citron-juice, &c. See what is proposed in the *Materia Medica* corresponding to this number of the present aphorism.

3.] It appears from physiology, that there are bibulous veins which open throughout the whole external and internal surface of the body, which are capable of absorbing any contiguous liquor or moisture, and of conveying it immediately to the blood; from whence it is evident that the external application of corroborating remedies to the skin may be of great service. For

those

those things which are recommended in the first number of this aphorism, being thus applied in the form of an epithem, insinuate their most subtle and fragrant parts into the bibulous veins, from whence they pass immediately with the venous blood into the heart, and from thence are distributed by the arteries throughout every part of the body. Hence a sudden refreshment or increase of strength follows, inasmuch as the spirits and powers of the heart are excited by these most grateful stimuli, which have not received any alteration from the actions of the viscera. It is usual to apply these epithems to those parts where the large veins lie most exposed; as for instance, under the arm-pits, in the hams, neck, &c. that the effluvia absorbed by the bibulous veins may pass immediately by a direct course into the larger veins. But they seem to be useful not only when applied in this manner to the blood-vessels; but also when applied to the nerves, which have a considerable influence upon the vital functions of the body, as we know by experience: Thus the nerves dispersed through the internal surface of the nose are so affected by the scent of new bread lately drawn out of the oven, that the fume alone of the bread is sufficient to preserve a man from fainting who is ready to fall into a syncope from too much fatigue of body; and the same may be said of almost all aromatics, whose fragrancy alone, by the smell, immediately recruits the vital powers and influences of the nerves. Hence it is that such epithems are frequently applied with very good success to the cardia, where the large nerves form a plexus about the upper orifice of the stomach; and they are also no less successfully applied to the navel. These remedies have sometimes an incredible efficacy thus externally applied, as we learn from practical observations. A man was much wasted by a severe heartburn, which returned every day, with intolerable pain, about four hours after eating, unless the patient strongly compressed the cardia or pit of the stomach against the table; which made him believe that an incurable cancer was fixed in his stomach: and yet Helmont^d relates that

^d In capitulo, *Imago fermenti impregnat.* &c. n^o. 22. p. 23.

that he saw this disorder cured in a few hours time by the application of an aromatic plaister, hardly larger than a hand's breadth. Infomuch that the same author not without some reason concludes, that almost all medicines act by their smell, that is, by their most subtle and spirituous parts; for so soon as they are deprived of their natural odour by long keeping in the shops, they are also deprived of their virtues. Thus when scammony has lost its cadaverous smell, it becomes quite unactive; and if castor has lost its smell, it is no longer of any efficacy, &c. But to keep up the patient's strength, it is required to apply these epithems in such a manner as to prevent their most subtle and fragrant parts from exhaling externally into the air by the heat of the body: for this purpose, therefore, take a piece of toasted bread, which is very dry and bibulous; moisten it with such an epithem, (of which various forms may be seen in the *Materia Medica* corresponding to this number); and apply it to the naked skin; after which, cover the whole with a sheep or hog's bladder that has been first rubbed with oil, securing the same upon the part with a suitable bandage.

§. 435. **T**HE putrefied humours are prevented from returning into the veins. 1. By keeping up the patient's strength (434); and consequently the motion of the blood and humours is to be augmented *ad extra*, from the heart outwards. 2. By procuring them to be discharged externally, by fomentations and cataplasms, formed of diaphoretic, emollient, and laxative remedies; with scarifications, cupping, leeches, and external warmth.

The second general indication in the cure of a gangrene (§. 433, n^o 2.) was to prevent the putrid humours from returning into the veins. For the gangrenous parts adhere on all sides to those which are sound, by the living vessels; or at least they remain in close contact together, and usually by degrees spread the putrefac-

trefaction: and therefore the putrid matter may be very easily absorbed by the veins; and thence the very worst consequences may follow, namely, a putrid fever, delirium, and sudden loss of strength, &c. Now this return of the matter through the veins may be prevented by the following methods.

1. Such things as procure a free motion of the humours thro' the vessels are said to increase the strength, as we observed in the commentary on §. 433, n^o 1; and therefore those things which are enumerated under the preceding aphorism, do at the same time so increase the vital powers when they are languid, that those humours are freely exhaled and evacuated by the smallest perspiring arteries throughout the whole surface of the body, by which passages they ought to be naturally evacuated. Now so long as there is no impediment to this discharge by the exhaling arteries, an increase of the blood's circulation will evacuate a larger quantity of humours by the skin, whether in the form of sweat or insensible perspiration; the reason of which is evident, since a greater quantity of humours are applied in the same time to the secretory and excretory organs of this part of the body. But while the exhaling arteries are thus dilated and urged by the greater quantity and impulse of the humours outward, the contiguous absorbing veins must consequently be compressed, and therefore it will be more difficult for any contiguous humour to be absorbed or sent thro' them. To which add, that the heat which accompanies an increased motion of the humours through the vessels, will in a great measure dissipate what might have been absorbed. Therefore, in all diseases in which the circulatory motion of the blood is increased, a dryness arises, from the exhalation of the thinnest juices; and, on the other hand, in languid or chronical diseases, the body becomes turgid and swelled with accumulated humours, from the too great slowness and weakness of the circulation. But how much the small veins seated in the surface of the body are capable of absorbing when the vital powers are languid, we are taught by those wonderful instances which we shall mention hereafter in treating

treating of dropfies. For it appears, that the bodies of dropfical patients have fwelled again in a little time after all the water has been extracted, even although they were fed upon none but the driest food, and drank little or no liquor of any kind. Whence it seems to follow, that the bodies of such patients must have absorbed that water from the moisture of the air by the inhaling veins. It will be therefore of the greatest use so to increase gently the circular motion of the juices, as to prevent the ingress of the putrid gangrenous humours by the veins, and thereby hinder their return into the blood; and, if any of them are already got into the mass, to endeavour to evacuate them again by urine or by the cutaneous pores, by increasing the motion of the humours outwards while the patient's forces are kept up.

2. In treating of the cure of abscesses, we observed that it was highly necessary to discharge the crude inflammatory matter as soon as it had arrived to maturity (§. 402, n^o 3.) lest, being absorbed, it should infect the blood with a purulent cacochymy, and give birth to a great number of the worst diseases (§. 406.) But, in the cure of a gangrene, the corrupted juices are to be more diligently thrown outwards, in proportion as the gangrenous matter is more malignant or corrupt. But nothing is a greater hindrance to the discharge of this matter outwards, and at the same time more suppresses the circulation in the subjacent parts yet living, than the gangrenous skin when it becomes hard and dry like leather; for in that case, if the circulation is augmented in the yet living parts confined within the skin, they will be all of them corrupted. The best method therefore will be, continually to foment and moisten the gangrenous parts by the application of cataplasms or fomentations, and to open all the pores in such a manner that the living vessels may have a free perspiration. To answer this intention, water, and all remedies in which water predominates, with the addition of such things as have a power of softening and relaxing, are used. But since the circulation of the humours is too languid in the gangrenous part, and consequently

frequently the heat or warmth must be defective, it will be therefore necessary to apply an external warmth, to prevent the fomentations and cataplasms from growing cold. But this intention may be very well answered by applying hot bricks or tiles, of which there are various kinds of different figures and magnitudes to be had here in *Holland*; some of which are called *Kolyksteen*, from the good effect which they have in relieving cholic pains. It is indeed true, that warmth and moisture applied in this manner will increase the putrefaction in the dead parts, but at the same time they will facilitate the separation of them from the living parts; and therefore these remedies ought never to be used but when there are hopes of obtaining such a separation. This is a prudent admonition of Celsus, who in treating of the cure of a gangrene, says, *But when the disorder spreads, none of those medicines which commonly serve to promote suppuration are to be used; and therefore even warm water itself is to be excluded*^c. For so long as the disorder spreads, the putrefaction will by these means be increased, and all the adjacent parts will be infected so much the sooner. But it is usual always to mix with cataplasms and fomentations for a gangrene, such things as very strongly resist putrefaction, and by their penetrating aromatic force reduce the stagnating humours into motion. But as all these aromatic ingredients are easily dissolvable in water, and have at the same time a very-subtile fragrantcy, by which all the vessels are opened, and that without too much augmenting the motion of the humours; they therefore usually increase the evacuation of them through the pores of the skin, and are from thence called *diaphoretics*. In the *Materia Medica* corresponding to the number of this aphorism, there are extant several forms of this nature, in which the emollients and laxatives are mixed with aromatic ingredients, as rue, alliaria, elder flowers, hops, flowers of chamomile, &c.

Scarifications.] Which are more especially useful
when

^c Medicamenta vero, dum malum serpit, adhibenda nulla sunt, quæ pus movere consuerunt; ideoque ne aqua quidem calida. *Lib. v. cap. 26.*
n^o 34. p. 303.

when the panniculus adiposus is distended to a great thickness with inflammatory matter, so as to become gangrenous: for then the great weight of the incumbent corrupted or dead parts compresses the vessels, and intercepts the circulation in the subjacent living parts; and at the same time the cataplasms or fomentations which are applied cannot penetrate with their virtues, so as to prevent the ingress of the putrid matter by the absorbing veins. Hence scarifications of the gangrenous parts form as it were outlets, by which the corrupted humours may be expelled from within, and a passage given to those remedies which correct the present putrefaction, and prevent the future. But these scarifications ought to be continued through the dead part, even down to the living; but yet without injuring the latter: for thus the whole business may be performed without pain, and the putrid matter will not meet with a ready entrance by the veins which have been opened by wounding the living parts; for the bites of venomous creatures demonstrate how easy any virulent matter is absorbed by the veins in a recent wound.

Cupping-glasses.] For by removing the pressure of the atmosphere from that part to which the cupping-glass adheres, the impetus of the blood flowing thro' the yet living parts will distend the vessels, elevate the incumbent dead parts, and repel the putrid matter. Even when the adjacent living vessels are so compressed by the dead parts, that the impulse of the humours is not sufficient to distend them; even then, by removing a great part of that pressure with cupping-glasses, there will be a free passage again afforded to the humours through those compressed vessels; and thus life will return in the parts which tended to mortification by a destruction of all the vital influx and efflux of their humours. But how great efficacy cupping-glasses have in order to recover the deficient life and nutrition of the parts, we are informed by Tulpus: A young sailor had such a considerable discharge of matter from a large abscess in his arm, that the whole limb was afterwards depraved in its nutrition, so that it fell away or decayed

decayed greatly. But when the whole arm was almost withered, some cupping-glasses of horn were several times applied, by the force of which the warmth and nutrition so well returned into the limb, that it recovered its former strength and bulk, so that the patient was capable of using it about his naval employments. Cupping-glasses have also a very good effect when applied to the living parts which are near to the gangrenous, in order to increase the quantity and impetus of the vital humours flowing thither; and thus also the fibres which connect the gangrenous with the sound parts, are at the same time dissolved, so as to procure a separation of them, as we shall hereafter explain at §. 444.

Leeches.] This animal makes a small wound, with its three-cornered mouth, in the skin of the part to which it is applied, and frequently adheres very firmly, sucking out the blood, until it falls off by being greatly distended with that liquor, or until it is made to desert the place by a little nitre, salt, or the like, being sprinkled upon it. But the blood very often continues to flow even some time after the leech has been removed, more especially when it has been applied for the piles, insomuch that many authors who have written concerning the use of leeches, have prescribed remedies for suppressing the profuse hæmorrhage which follows in that disorder after the application of leeches. All that the leech does, therefore, is to wound the small vessels; and then, by sucking, to evacuate their blood; so that, by diminishing the resistance to the blood in the part, they cause a derivation of it in greater quantities, and with a more powerful impetus: hence they produce much the same effect with cupping-glasses, more especially when scarification is used at the same time with the cupping. Leeches may be therefore used in those cases where the patient is afraid of scarification and cupping, or when the nature of the affected part is such as not conveniently to admit the application of cupping-glasses. But these small animals will not readily fasten or bite a dead or gangrenous part, and therefore they must be applied to the living skin adjacent to the parts affected.

From all that has been said under this aphorism, it appears that the same method is to be followed in this case which the ancients used for the bites of venomous animals. Celsus^s in that case recommends the application of cupping-glasses, and incisions to be made with a scalpel about the part which has been bit, in order to evacuate more of the vitiated blood. But if cupping-glasses cannot be had, he orders a person to suck the wound; which, he observes, may be very safely done, provided the person has no wound or ulcer in his mouth. In the next place, he would have the patient who has been bit, placed in a warm room, and the parts fomented while they yet remain warm, after incisions have been made through the middle of the flesh which was bit by the venomous animal; and then to give the antidotes, &c. which if not to be had, he would have a quantity of wine and pepper to be drank, or any thing else which is capable of exciting heat in the body.

§. 436. **T**HE incipient putrefaction is corrected, first, By removing its sensible causes (422, 423, 424, 425.)

Nothing can be determined from this general rule; except only that it is first necessary carefully to discover and distinguish the causes which are enumerated in the aphorisms here cited, and from whence a gangrene with its consequent putrefaction derive their origin. For what may be very serviceable in one case, may be highly pernicious in another: as for instance, in a gangrene arising from great weakness or old age, warm cordials and stimulating medicines will be of the greatest service; whereas they would be most highly pernicious in a gangrene following from an inflammation in a young person of a warm habit.

§. 437. **I**N the second place, By correcting the proximate causes of the putrefaction, namely,

namely, the stagnation and warmth of the juices :

1. By preserving, or as it were pickling them, so as to resist a putrid state.
2. By arming the solid parts in the same manner against the like accidents.
3. And lastly, By procuring a due motion to the stagnating and corrected juices through their vessels, which are also armed or secured by proper remedies.

How much stagnation and warmth conduce to putrefaction, has been frequently observed before. A man may live in health for the space of eighty years, without any putrefaction in his body; whereas the dead body of a most healthy young person will putrefy in the space of two days, provided the ambient air is very hot. For stagnation alone does not cause putrefaction, at least but very slowly; as we are assured from the flesh of slain animals, which will keep sound for many weeks during the severe cold or frost of the winter. Nor does heat alone easily corrupt bodies, unless it is also accompanied with stagnation: for rivers perpetually exercised with a free motion, always afford a pure and limpid water, even in the greatest heats of the summer; and on the contrary, the water which is collected in lakes, or which stagnates in other receptacles, exhales a most disagreeable smell. Galen has very well expressed himself in this respect, when he says, That all putrefaction seems to arise from moisture; but that the efficient cause is an extraneous and preternatural heat, assisted at the same time by rest or immobility^a. In order therefore to restrain and correct the present putrefaction, it will be proper to qualify the too great heat (§. 433, n^o 3.) and reduce the stagnating juices into motion.

1. Since the cure of a gangrene requires the stagnating humours to be put in motion, so as to mix again with the whole mass, and circulate through the vessels, it is evident that the greatest caution is necessary to prevent their putrefaction; for if they are put into mo-

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tion

^a Comment. 3. in lib. iii. Epidem. Charter. Tom. IX. p. 256.

tion in a putrid state, they would destroy the most tender vessels, and corrupt the sound humours with which they mix. For, in the commentaries on §. 86, it was proved, that the texture of the blood dissolves by putrid matter, and that the smallest vessels are destroyed, and therefore all the actions of the solid and fluid parts are by that means depraved; from whence innumerable disorders follow. In the putrid scurvy, and in atrabiliary habits, we see plainly how dangerous it is to put the corrupted and stagnating humours into motion, as we shall explain hereafter when we come to treat of those disorders.

2. For not only the humours are changed and corrupted by putrefaction, but even the solid parts themselves lose their cohesion and firmness, insomuch that the flesh of animals dissolve into a putrid liquor by putrefaction in a hot and moist air. But the degree of cohesion is more or less diminished in the flesh of animals according to the degree of putrefaction with which they are invaded, as we are taught by daily experience in the kitchen: for the flesh of animals lately killed is usually tough, if it be dressed soon after; whereas, after keeping some days, that toughness in a great measure goes off; and if the flesh is kept in the open air till a slight putrefaction begins, it becomes extremely tender, and dissolves in the mouth with but little mastication. Hence Pliny records, that the Gauls tinged their arrows with the juice of hellebore when they hunted; and after cutting out the wound, they affirmed that the flesh was by that means rendered more tender^b: For the venomous force of the hellebore disposed the flesh to an incipient putrefaction.

3. After the two first intentions are answered, then the humours may be safely put in motion: otherwise if the stagnating humours possess any considerable degree of acrimony or putrefaction, or if the strength of the vessels is much decayed, or if both these defects concur together, the small vessels will then suddenly burst, their humours extravasate, and the putrefaction increase, so as to augment instead of curing the disorder,

^b Hist. Natur. lib. xxv. cap. 5. p. 634.

der, as is evident from what has been said in the commentaries on §. 388.

§. 438. **T**HE juices are preserved, or as it were armed, against putrefaction; by the application of salt, vinegar, wine, spirit of wine, and spices.

We are furnished by the *Materia Medica* with such remedies as are capable of preserving the parts of animals from all manner of putrefaction; but besides this, it is also necessary to reduce the stagnating humours into their free motion through the vessels, after they have been thus corrected or preserved, and the vessels themselves fortified: from whence it is evident, that these antiseptics ought to be such as will not destroy the necessary qualities of the vessels for transmitting and moving the juices; so that they are not to be preserved like the parts of a dead body, but life is to be at the same time maintained in them, and restored if deficient. But this intention will be answered principally by the application of the following.

Salt.] The flesh of animals which corrupts in a few days, is preserved sound a long time after it has been sprinkled all over with sea-salt, or immersed in a brine of the same; but then it is remarkable, that the flesh by that means becomes harder. The chief salts applied in fomentations to gangrenous parts, are sea-salt, sal-gem, sal-ammoniac, and nitre.

Vinegar.] Which is extremely averse to all putrefaction, whence it was in great use with the ancient physicians in all putrid disorders; even the smell or vapours alone of vinegar revive the sick patient in putrid diseases. It appears from daily experience that the flesh of animals may be as well preserved from putrefaction by vinegar as by salt. In the mean time vinegar has this good quality over salt, That it does not so much harden the fibres or vessels, nor coagulate the juices; but rather dissolves or attenuates the blood. Even all the stronger acids which are obtained by the force of fire from fossils or mineral salts, such as spirit of nitre,

sea-salt, vitriol, sulphur, &c. do all of them indeed defend from putrefaction; but then they coagulate the juices, and contract and harden the solids, which they even dissolve and destroy if they are not sufficiently diluted: from whence it is evident, why this mild acid, namely vinegar, which is prepared by a gentle fermentation, is in this disorder preferable to those stronger acids which are obtained by the force of fire.

Wine and spirit of wine.] It is a thing well known in Germany, that boar's flesh is preserved by macerating in wine, and that it shrinks by that means; whence it appears that wine has an antiseptic quality resisting putrefaction, and is therefore suitable to this indication. Spirit of wine, and the alcohol which is thence prepared, is therefore a most efficacious remedy against putrefaction; but then, at the same time, it coagulates the blood and its serum, corrugating and contracting the vessels: so that by this we may be able to preserve the dead part of the body, and prevent the mortification from spreading; but then life can never be recovered again in those parts which have been preserved by long macerating in the alcohol. Thus, in that wonderful case which we mentioned in the commentary on §. 429, n^o 4. the mortified leg was anointed every day with spirit of turpentine, and it did not putrefy, but continued adhering to the living parts dried up like a mummy. Spirit of wine will be therefore rather more serviceable when diluted with water: for then it may be both capable of preserving the parts from corrupting, and avoid injuring or drying up the vessels; so that it will not shrink the solids, nor coagulate the fluids, as it is so much weaker.

Spices.] Of these there are several sorts enumerated in the *Materia Medica* corresponding to this aphorism, in which there is a power not only of preserving dead bodies for a long time, but also of reviving the strength of those who are ill, by their grateful effluvia: but the principal among these recommended for this purpose are scordium, alliaria, rue, sage, hore-hound, wormwood, tansy, &c. Concerning scordium, Galen^a relates

^a De Antidotis, lib. i. cap. 12. Charter. Tom. XIII. p. 883.

a wonderful story; viz. that some men of indisputable credit wrote to him, that after a battle the dead bodies lay unburied for several days, and those who lay among the scordium which grew in some parts of the field were much less corrupted than the others, and that even of these bodies the parts which touched that herb remained the least corrupted. Hildanus^b recommends the same virtues in alliaria, tho' he even gives the preference to scordium; and yet he attributes so much to that herb in the cure of a gangrene or sphacelus, as also in putrid and sordid ulcers, that he preserved the expressed juice of the plant in glasses with oil on the top, that he might not be destitute of this salutary remedy in the winter-time. But in all these plants there is a subtle fragrancy, upon which their medicinal virtues principally depend; and which by long boiling, especially in open vessels, exhales into the air, and leaves the decoction with little or no virtue in it. The best method, therefore, will be to infuse this herb in a close vessel, by pouring on scalding water; and, after expressing the juice, to add some wine, vinegar, salt, &c.: or else the recent herb being ground to a poultice, may be mixed with vinegar, salt, &c. and applied to the gangrenous parts in the form of a cataplasm. But of what service these and the like remedies frequently are, may appear from what has been said in the commentaries on §. 388.

§. 439. **B**Y the same means (438) also the solids are preserved from being injured.

This is sufficiently evident. For the solid parts do not easily corrupt of their own nature; but because of the juices which they contain, or which are brought to them: whence the parts of animals may be a long time preserved without putrefying, after their contained juices have been exhaled or dried up.

§. 440. **T**HE stagnating humours are reduced into motion, 1. By diluting them with

^b Observat. Chirurg. cent. 2. obs. 94. p. 171.

with watery liquors drank plentifully, and applied also to the parts themselves. 2. By stimulating the arteries with such remedies as are opposite to the disorder. 3. By moving the juices themselves by heat, frictions, and cordials. 4. By removing the too great quantity of juices over-distending the vessels, by bleeding.

It is evident, from the definition of a gangrene, (419), that the juices stagnate in their containing vessels in the affected parts; since the vital influx of the humours by the arteries, and the efflux of them by the veins, ceases in this disorder. But the particles of our juices unite together by rest or stagnation, as we demonstrated in the commentaries on §. 117: And therefore, to reduce the stagnating fluids into motion, it is required that the concreted particles be again divided from each other, in order that they may pass thro' the narrowest extremities of the vessels; and then they are to be put in motion, of which they were before destitute: at the same time the vessels are to be relaxed or opened, if they are contracted or diminished in any part. All these intentions are answered by the following.

1.] The whole skin is replenished with the mouths of small absorbing veins throughout every part of the body; and therefore diluent medicines, applied externally to the affected parts, may insinuate themselves by the mouths of these veins, and mix with the blood itself, so as to pass by the laws of circulation throughout every point of the body. But how much force diluent and resolving medicines have in removing the concretions of stagnating juices, was said before in the commentaries on §. 132, n^o 2. and 134.; where it was also demonstrated, that diluent fomentations, applied to the affected parts, were not only serviceable inasmuch as their watery parts insinuated immediately into the absorbing veins, but also because they relax the vessels, and derive the vital humours more copiously and powerfully into the affected parts; and that by this means the diluting liquors which were taken internally,

ternally, and mixed with the whole mass, were more particularly derived into these parts. If now we also consider what has been said in the commentary on §. 398, n^o 3. it will appear, that diluent medicines may by external application enter the extremities of the exhaling arteries themselves; namely, when their larger branches are obstructed; for then these ultimate extremities being empty of their fluids, will attract or draw in the liquors by that power which is common to all small tubes. If then a large quantity of liquors of the same nature is drank, while in the mean time these external applications are used, a resolution of the concremented fluids will be procured in as great a degree as is possible for diluent liquors to effect.

2. But since water is the only liquor which dilutes our juices, and as that is in itself unactive, a motion is therefore required in the heart and arteries to move and actuate the same. But in the gangrenous parts there is a stagnation; so that although diluents are applied both externally and internally, yet they will not produce any good effect, unless a motion is excited in the juices at the same time. Hence therefore an increased motion of the humours throughout the whole body, that is, a moderate fever, will be always serviceable in this case; and therefore it is usual to exhibit such things as moderately augment the circulation by a gentle stimulus, (see the commentary on §. 398, n^o 1.) such as an infusion of *sassafras* wood, the three sorts of *sanders*, *rue*, *alliaria*, &c. And since all our juices spontaneously tend to putrefaction when they stagnate, as we observed at §. 80. therefore it is usual to add pleasant acids, and more especially the expressed juices of vegetables, as of citrons, oranges, currants, &c. or fermented acids, as wine or vinegar; all which rather attenuate and dissolve, than coagulate, the blood. Now according as there is danger of a greater or less putrefaction, more or less of acids is to be used in the diet and medicines. But when the gangrene arises from old age, weakness, or a cold and phlegmatic indisposition of the juices, while as yet there are no signs of putrefaction, it will then be proper to use volatile
oily

oily salts, elixirs, aromatic tinctures, &c.

3. By heat.] Perfect life, that is, health, in the human body, is always accompanied with an equal heat diffused throughout every part, even to the extremities. The vital powers being either increased or diminished, the heat is proportionably greater or less; and at length in the dead body, where life ceases, there is an absolute cold and rest. But heat or warmth is not only a concomitant and sign of present life; but also, when life is as it were hid or dormant, it is roused and rendered active by warmth. Thus we see, that frogs in winter are in a manner dead, and lie buried, without the least motion, even in the midst of ice; and yet they recover their activity, after they have been brought into the hot-house or bagnio. The vital stamen of the chick lodged in the sacculus of colliquamentum in the egg, continues there unactive and without growing, until it is reduced into action or life by a due degree of warmth; and it even appears from the lasting observations of the penetrating Reaumur^c, that the life of insects may be excited and depressed, prolonged and shortened, at pleasure, by exposing them to a greater or less degree of heat. Even the ancients seem to have been acquainted with this wonderful property of heat or fire, by which every thing in nature is animated. Thus Plutarch writes, that the most wise king Numa ordered fire to be worshipped, as the principal cause of all things. *For fire is the most active substance in nature: It either is motion itself, or is generated with motion. Other parts of matter, destitute of heat, lie sluggish and dead, and crave the force of fire as an informing soul; and when that comes, they acquire some active or passive quality*^d. Hence therefore it is evident how much may be expected from external heat, in order to reduce the stagnating juices into motion; provided those remedies are used at the same time which prevent putrefaction,

^c Memoires pour l'Histoire des Insectes, Tom. II. Mem. 17.

^d Mobilissimus enim in natura ignis est. Motus autem est, aut cum motu ejus generatio. Aliæ vero materiæ partes, calore destitutæ, torpidæ jacentes et mortuis similes, desiderant ignis vim, velut animam: quæ simulac accessit, conferunt se ad agendum aliquid aut patiendum. *Plutarchi Camillus, Tom. I. p. 139.*

faction, which might otherwise be feared from thence.

Frictions.] Concerning the several uses of friction, and the manner in which it increases the motion of the humours through the body, or through the parts affected, we treated before in the commentary on §. 28. and therefore it may be sufficient for us here to remark, that the alternate pressure and relaxation of the vessels made in every friction supplies their action upon the contained humours; so that thus the stagnating juices may be moved through the vessels, agreeable to the design of this intention. Frictions will be therefore extremely useful in a gangrene which arises in the extremities from weakness or old age, or when it is only approaching: but when a gangrene is feared after violent inflammations, the more soft frictions only, very cautiously and prudently applied, can be of any service; for by a more rough treatment of the vessels distended with impervious juices, they would be ruptured and destroyed.

Cordials.] Since the heart is the principal cause of all those motions by which we estimate the vital powers, therefore all such remedies as increase these motions are termed *cordials*, even though they do not always act immediately upon the heart itself. But cordials are chiefly of two kinds; namely, such as fill the vessels with proper juices, or such as put in motion those juices with which the vessels are already filled: It is of these latter we here principally treat, since the curative indication requires the stagnating juices to be put in motion. For this purpose, wine, with the juice of citrons, oranges, and the like pleasant acids, are chiefly serviceable, since they are also opposite at the same time to the putrefaction to be feared in a gangrene. See a regular list of these cordials in §. 1112. of Boerhaave's institutes.

4. Since it was said before, that, in the cure of a gangrene, the stagnating humours were to be put in motion, and the vital powers excited, it may perhaps seem wonderful that we should now recommend bleeding in the like disorder, since that is well known to diminish the quantity of the humours, and to weaken the

the vital powers. But, notwithstanding, this evacuation will be always serviceable when there is a plethora either throughout the whole body, or else in the particular part itself affected, whose vessels are stuffed up with impervious juices, and too much distended by the force or impulse of the juices urging behind the obstructions: for it was demonstrated in the commentary on §. 106, n^o 4. that a stoppage of the circulation, and a rupture of the vessels, or a gangrene, was to be feared from too great a fulness; and, in the commentaries on §. 100, it was proved, that the same bad consequences would follow from too great a motion of the blood through the vessels. It was also observed, in the commentary on §. 398, n^o 1. that bleeding diminished the quantity of distending humours, and restored the vessels to their elastic vibrations, which is extremely necessary to procure a motion in the stagnating juices.

It might perhaps be feared, that emptying the vessels by bleeding would facilitate the absorption or return of the matter into the depleted veins: but this is a scruple which ought not to be admitted, unless there is also a fever attending at the same time, by which the juices have a violent motion outwards, so as to prevent the ingress of the putrid matter by the veins, (according to §. 435, n^o 1.) Besides this, the putrefaction cannot be considerable so long as there remains any hopes of restoring the stagnating juices to their proper motion through the vessels which are as yet sound. So that although some putrid humours may enter the incipient veins, they may nevertheless be washed out from the blood by plentiful drinking of diluent liquors (see n^o 1. preceding), and evacuated from the body either by urine or sweat.

§. 441. **B**Y these remedies timely applied (434 to 441,) and frequently renewed, an incipient gangrene is very often happily cured by a mild correction and diaphoresis.

We ought not easily to despair, even though a gangrene

grene appears to be invading the part, provided those signs are not yet present by which we discover the vessels to be actually broken and their humours extravasated. For if all these remedies mentioned in the preceding aphorisms here cited, are timely applied, and the use of them carefully continued, we very often find that life returns again into the parts which were supposed to be dead. Nor can it be of any bad consequence to make trial of these remedies, even when there is but the least hope of success; because the very same remedies are also used in those cases where nothing more can be expected than a separation of the dead from the living parts, as we shall explain at §. 445.

Notwithstanding, therefore, the symptoms of a most violent inflammation may suddenly go off, without any correction of its cause; and the heat of the affected part, which before looked very red, now begins to lessen or change; or even though some small pustules appear in the skin, filled with ichor or lymph; even then these remedies may be tried with some hopes of success, since as yet we are only informed that the small vessels are ruptured which connect the cuticle and true skin together. For it was said in the commentaries on §. 419, that it is not always easy to distinguish betwixt a most violent inflammation and an incipient gangrene; because a violent inflammation tends to the death of the parts, and in an incipient gangrene the life of the parts is not yet removed or destroyed. When therefore the disorder seems to be in a state betwixt an inflammation and a gangrene, the most efficacious remedies are to be used at one and the same time: for if the same causes continue to act, the vessels will soon be destroyed, and their extravasated juices will stagnate and putrefy; and the vessels being once destroyed, there is no longer any hopes of reducing the stagnating humours into their proper motion. The remarkable case alledged in the History of Contusions, in the commentary on §. 338, teaches us how suddenly and unexpectedly this method has been attended with success, even in the most deplorable cases.

§. 442. **B**UT if the juices are already putrefied, and their most fluid parts exhaled, while at the same time the vessels are also broken or destroyed, the disorder cannot then yield to these remedies, nor can the corrupted parts be restored to their former healthy state, but even the adjacent living parts which continue in motion will be much injured by those corrupted juices which are not capable of exhaling.

But while the several remedies are used, of which we treated in the two preceding aphorisms, the physician or surgeon ought to inspect the affected part every three or four hours if it lies within sight, and endeavour carefully to discover whether any signs appear of life returning or increasing in the part; or whether every thing advances for the worst, the colour being changed into a pale, brown, livid, or black; for then he may be certainly assured that the part is dead, and the vessels so far destroyed that there is not the least hope of restoring them to their vital motion. The stagnating juices therefore spontaneously degenerate into a state of putrefaction (§. 80), the solid fibres and vessels are dissolved, and the whole is the sooner corrupted in proportion as the air has a more ready access to the extravasated humours. But it was demonstrated in §. 82, that our humours received such an alteration by putrefaction, that the watery part exhales; and the salts, which were naturally mild, saponaceous, and in some degree fixed, become acrid, alkaline, and volatile; and the remainder of the oil which is more fixed, combines with the earthy parts, and forms a tenacious foul matter. All these consequences therefore follow when the part is possessed with a confirmed gangrene; and the dead parts, after exhaling their most subtle juices, are frequently dried up, so as to form a hard covering like leather, which is called the *gangrenous eschar*. But under this eschar the living parts lie concealed: and therefore if we stimulate the
arteries,

arteries, or much increase the motion of the juices through the yet living vessels, by cordials, frictions, or external heat, the living vessels will be pressed and rubbed against the hard and imperspirable crust; from whence a new inflammation will follow again, speedily tending to a gangrene: so that in a little time the disorder will be augmented into a sphacelus or complete mortification, in which all the parts are corrupted even to the bone; or the putrefaction will spread thro' the panniculus adiposus into the circumjacent parts, and by that means propagate the disorder by degrees throughout the body. This has been very well expressed by Celsus in the passage which we before quoted from him in the commentary on §. 429. where, after saying, concerning a gangrene, that the flesh of the ulcer appears black, livid, dry, and that the adjacent skin is generally full of dark-coloured pustules, he adds, that all these spread at the same time; the ulcer or gangrene creeps to the part where the pustules appeared, the pustules invade the part which looked pale or livid, while the pale or livid colour takes place in the parts which were inflamed, and the inflammation passes on to the sound part, &c.

§. 443. **T**HEREFORE the whole intention in this case (442) is, To procure a separation of the dead from the living parts.

Since there no longer remains a circulation of the humours through the parts thus affected, and as it is impossible to restore them to their natural state; it is evident, from what was said before, that the only remedy which then remains, is, to remove that which is already mortified, that it may not injure the subjacent living parts by its pressure, nor spread or infect them with putrid contagion.

§. 444. **B**UT this separation of the dead from the living parts is always performed by the vital force of the blood and humours rush-

ing against the borders of the gangrenous eschar; where being obstructed or suppressed, a suppuration is by that means produced (387); whence follows a dissolution of the fibres which connect the gangrenous to the sound parts.

But it may be asked, In what manner is this separation of the gangrenous from the contiguous living parts brought about? For the vital motion of the humours through the vessels cannot act upon the dead parts which are destitute of all motion; nor can this separation be obtained by that corruption or change which follows spontaneously in the parts, for no such separation is ever observed in a dead body. In fact, therefore, it only remains, that the living parts must separate themselves from that contiguous gangrenous crust to which they adhere. Now, there is always a redness and inflammation observed, as long as the vital powers remain sufficiently strong in that part where the gangrenous crust adheres to the sound or living parts; because there the humours flowing through the living vessels are stopped, being incapable of passing through the gangrenous crust. But this inflammation cannot be resolved or carried off by discussion, since it is impossible to open the extremities of the obstructed vessels; and therefore it must tend either to a suppuration or a gangrene, since in this case there is no danger of a scirrhus. All the endeavours of art therefore are to be directed to procure a suppuration in this part, namely, in the confines betwixt the gangrenous and sound parts; which may be obtained, either spontaneously, or by art, under those conditions mentioned at §. 387. The vital motion of the humours is therefore to be so regulated, as to be greater than in health, and yet not too violent; the mild nature of the humours is to be preserved, and their putrefaction prevented; and then the continual struggle betwixt the vital humours impelled through the living and pervious vessels to the gangrenous part, will by degrees break the sides of the vessels, and separate the cohesion of the living from the dead parts, while the humours ex-

travaſated from the ruptured veſſels are converted into matter, as was ſaid before in the commentaries on §. 387. But as the gangrenous or dead parts are no longer ſupplied with the vital juices, the more fluid parts of thoſe which they contained will be exhaled and dried up by the warmth of the adjacent living parts and the ambient air; by which means, contracting in all their dimensions, they will recede more and more from the living parts, ſo ſoon as the extremities of the living veſſels begin to be diſſolved by ſuppuration. Hereupon follows a fiſſure, which perfectly ſeparates all the dead or gangrenous from the living parts; and then there is no longer any danger of the gangrene ſpreading; The gangrenous eſchar now appears almoſt like an iſland in the middle of the living parts; the middle of it generally remaining fixed for ſome time after its ſides have been diſſolved or looſened; till at length, the ſame cauſes continuing to act, it daily contracts itſelf more and more, and at laſt ſeparates intirely from the ſound parts, leaving a clean ulcer.

That a ſuppuration is the only method by which nature can ſeparate the dead or corrupted from the living parts, was ſhewn in the commentary on §. 458, n^o 7. and confirmed by the authority of Hippocrates. Thoſe who would be wiſer than nature, and think to procure a more ſpeedy ſeparation of the dead or gangrenous from the living parts by incision, cauterization, &c. are certainly much in the wrong; ſince, in either of theſe methods, ſome of the dead parts are left behind, or elſe the living parts are deſtroyed together with thoſe which are corrupted. For when butter of antimony, or the cauſtic liquor prepared by diſſolving mercury in aqua fortis, which Belloſte ^a highly recommends, is applied to the gangrenous parts which are next to the living parts, the putrefaction may indeed by that means be ſometimes prevented from ſpreading, but a ſeparation of the dead from the living parts never can be this way effected: For whatever living parts are touched with thoſe cauſtics, are immediately deſtroyed or killed, and muſt be again ſeparated afterwards from the living

^a Chirurgien d'Hopital, part 3. chap. 2. p. 189, 190.

parts by a suppuration. Therefore all that can be effected by this means, is to prescribe limits or bounds to the spreading gangrene; in which bounds or limits the parts are indeed dead, but so changed by these penetrating and powerful acid spirits as to prevent the putrefaction from spreading any farther. Thus an intermediate circle is formed betwixt the gangrenous or corrupted and the living parts, by which all intercourse or communication betwixt them is cut off. But this intermediate margin is itself a dead substance, and must be separated from the living parts with which it coheres; and that separation can be only performed by a suppuration procured by nature, as we immediately before observed.

We are taught by chirurgical observations, that the scarification of gangrenous parts is often very useful, in order to suffer the antiseptic remedies to penetrate more deeply into the parts, and to prevent their putrefaction; but then it also appears from the same observations, that the method of separating the gangrenous from the living parts by the knife is always unsuccessful. The celebrated le Motte ^b, whom we have so often quoted, ingenuously confesses that he several times attempted to separate the dead from the living parts by the knife, having seen the same practice in the hospitals by surgeons of the best repute; but that he always found this method attended with the worst success. A gangrene arose about the os coccygis in a woman, who, lying ill of an acute disease, discharged her fæces insensibly: the spreading of which gangrene was in vain attempted to be stopped by slight scarifications; nor was there more success from a deep incision made all round so as to separate the gangrenous from the living parts, defending them at the same time with antiseptic fomentations. He afterwards cut off the gangrenous or corrupted parts, whence the patient was obliged to lie upon either side; and, by removing in this manner the corrupted parts by repeated incisions, he laid bare the whole os coccygis, and a large part of the os sacrum,

to—

^b Traite complet des Operations de Chirurg. Tom. III. obs. 298, 299, &c. p. 335. et seq.

together with the trochanters of each thigh-bone, and part of the ossa ilia, till at length the miserable patient expired; and he adds, that he has frequently seen the same method used, but always without success. Nor is this at all wonderful, since in such a case the dead or gangrenous parts are a defence to the subjacent living parts, that they may not be corroded and injured by the urine and fæces. Add to this, that so long as there is any such acute disease attended with an insensibility of those parts, the mere weight of the superincumbent body will choke the circulation in the crude living parts when freed from their gangrenous covering; or, if the posture be changed, that weight being removed to other parts will, merely by its pressure, produce new gangrenes there. But when in such a case the gangrenous parts are only scarified in a slight manner, and the putrefaction prevented by efficacious fomentations, leaving the whole separation to nature, the cure is generally observed to succeed well, the disease being overcome, and the vital powers recruited; and this even when the gangrene is very deep, as the forementioned author confirms by several instances: He even confesses that he has often seen those gangrenous crusts separate spontaneously in poor people, without any manner of care, after they have been occasioned by long lying upon the os coccygis and adjacent parts. I remember to have frequently observed the same thing myself, the separation succeeding without any scarification; only with the application of a little wine, vinegar, and salt, to foment the parts, and preserve them from putrefaction.

§. 445. **I**T is therefore evident that the assistances of art consist, 1. In performing what is mentioned before (433, to 441.) 2. In expediting or hastening the suppuration. 3. In mollifying or softening the eschar.

Since therefore it is evident, from what has been said, that a perfect separation of the dead from the living parts can be only effected by a suppuration; this

ought then to be promoted and hastened by all the assistances of art: and at the same time, while this is performing, care is to be taken to prevent too great a putrefaction from arising, which might infect the adjacent parts, or being absorbed by the veins might disturb the whole body. But of this we have treated in the aphorisms here cited. But since the gangrenous eschar is sometimes dried or hardened like leather by the dissipation of its juices; it is evident that the eschar may be more easily separated after it has been first moistened and mollified.

§. 446. **T**O hasten the suppuration, it will be serviceable to scarify the corrupted down to the living parts; for by that means the too great suppression of the circulation will be lessened, and an abscess formed instead of a spreading gangrene, by which abscess or suppuration the gangrenous skin and fat are generally separated from the subjacent and as yet living parts.

In some parts of the body the panniculus adiposus, in which a phlegmon and gangrene are generally seated, is of a considerable thickness; and even where it is very thin, it becomes sometimes distended to an incredible bulk when inflamed and stuffed up with impervious blood and juices. If now a gangrene is seated in this fat membrane, the living muscles and their tendons, &c. will be buried under this dead mass, nor will they be capable of removing the same, whence there will be danger of intercepting the circulation, and occasioning the gangrene to turn into a sphacelus or a compleat mortification of the parts affected, extending even to the bones themselves. In these cases, it is sometimes usual to make transverse incisions^a across the former; but of such a depth as not to injure the subjacent living and sensible parts, continuing them however deep enough to divide the dead parts close to those which are living. For it would be both cruel, and frequently

^a Garengeot Traite des Operations de Chirurgie, Tom. III. p. 347.

quently dangerous, to divide the living parts with a knife; which would render the return of the putrid matter into the blood much easier by being applied to the open vessels in the recent wound, which yet is a circumstance that ought to be well guarded against. Accordingly the ancients^b have ordered the gangrenous parts to be incised only down to those which are living. Thus Celsus, in treating of the cure of a gangrene, says, That whatever part appears dry, and has also the adjacent parts disordered with a sort of distension, ought to be incised even to the sound or living parts^c. For by this means there are a sort of out-lets made, by which the subjacent living vessels may rise up and remove the incumbent dead parts, so as at the same time to renew and supply the lost substance which was consumed by the gangrene. Perfectly the same thing is here performed as we mentioned in the History of Wounds in the Head, namely, by perforating the bones of the scull with many small foramina of different depths according to the degree of corruption or caries in the bone; for then the subjacent living vessels rise up through those perforations, throw off the foul part of the bone, and regenerate the lost substance. Besides this, the gangrenous parts being thus divided, there is a more ready entrance afforded to the antiseptic fomentations and other medicines, to penetrate equally throughout the dead parts, and to defend the living parts from all putrefaction; and at the same time also the eschars being softened, may be more easily separated by the insinuation of the emollient remedies applied to the incisions. After all these have been tried, if the vital powers remain strong, the living parts will be inflamed all round the margin of those which are gangrenous, whence a suppuration will follow, by which all those dead parts before divided and mollified by scarification will be gradually separated: and thus the gangrene will be turned into a foul ulcer, which yet will be depurated more and more every day, while in the mean time the skin and panniculus adiposus (which are

^b Galen. Meth. Med. ad Glaucon. lib. ii. cap. 11. Charter. Tom. X. p. 388.

^c Lib. v. cap. 26. n^o 34. p. 303.

are commonly the only seats of a gangrene, §. 420.) are consumed, and as it were separated from the subjacent living parts. But when a gangrene is seated in such parts as are only covered with a small quantity of fat, the gangrenous crust is then so thin as not to require those scarifications, which cannot then be made without injuring the subjacent living parts: As for example, when a gangrene arises about the os sacrum and coccyx by too long lying upon the parts, the gangrenous crust is seldom thick, because those bones are covered with little more than the naked skin.

§. 447. **B**UT for the blood to flow more powerfully and plentifully into these confines betwixt the dead and the living parts, leeches, cupping-glasses, and other attractive remedies, frequently applied, will be very serviceable.

Concerning these we treated in the commentaries on §. 435, n^o 2. But all these are to take place when the impetus of the vital humours is languid; for where there is a violent fever, it is often rather serviceable to diminish the too great force of the circulation. To which add, that these attractive remedies applied to the parts are serviceable, inasmuch as they derive or determine the diluent and antiseptic remedies taken internally to exert their virtues mostly upon those parts; concerning which, see what has been said in the commentaries on §. 134.

It may not be improper here to take notice of the use of the Peruvian bark in the cure of gangrenes and mortifications; since it seems to appear from late observations to be a specific in these cases, having a power capable of stopping the progress of the spreading evil, and of hastening the suppuration by which a separation is to be made of the dead from the living parts. Ten years ago a celebrated surgeon of Northampton, named Rushworth, wrote a letter to the Royal Society of London, recommending the use of the bark for stopping and curing gangrenes and mortifications, of which he

he affirms himself to have had many instances. In the year following, he wrote to Mr Amyand, that he had used the same remedy with success seven times in a complete mortification; and especially in an old man near eighty years of age, who had a mortification following a phlegmon, and which spread itself daily; but that, within twenty-four hours after taking the bark, a separation followed of the dead from the living parts, with a laudable suppuration or appearance of good matter. The same thing was afterwards confirmed by the testimony of many other celebrated surgeons. Thus in a man of forty years old, who had a mortification, without any manifest external cause, seated in the middle of the back of the foot or instep near the toes, there was a wonderful specimen given of the efficacy of this remedy: for after eight days trial with the usual external and internal remedies to no purpose, the sphacelus had spread through the whole foot, and had begun to affect the tendo Achillis; and all the physicians and surgeons expected the death of the patient to be unavoidable, placing no hopes in amputating the part, because there was a violent fever attending at the same time, his tongue appearing rough and dry, his looks wild, with thirst, restlessness, &c. so that it was unanimously agreed in this desperate case to make trial of the efficacy of the Jesuits-bark. A dram of this incomparable medicine was given every four hours to the patient; and the next morning every thing appeared to be altered for the better, even though the first dose was given but the evening before: for the fever and other symptoms were mitigated, and the patient rested quietly in the night, nor had the mortification made any advance. The next day a kind of moisture was discharged from the affected part; and on the third day, after giving the bark, there appeared two large abscesses at the ancles, from whence it was evident that there was no longer any danger of the mortification ascending higher. When again the bark was given in the same dose every sixth hour, a slight fever returned, nor was the appearance of the matter so laudable; and therefore it was again exhibited every fourth hour as at first,

first, and thus continued for the space of twenty-eight days; and after that again half a dram of the bark was also given every sixth hour, for five or six days longer. During the whole time of the cure the patient took ten ounces of the bark. All the muscles and tendons of the foot, which were already putrefied by a perfect mortification before the bark was given, were gradually separated or cast off; but the bones of the toes, metatarsus, and tarsus, were laid bare and cut off by degrees as they were corrupted. The whole cure was completed in about seven months; and the ends of the bones of the leg, namely, of the tibia and fibula, were almost entirely covered with a firm cicatrix, so that the patient could walk with a wooden leg, and afterwards acquired a good state of health^a.

There are many more cases of the like nature related in the same transactions, by which it appears that the use of the Peruvian bark has restrained gangrenes and mortifications from spreading into the adjacent sound parts; and that afterwards a happy separation has been made of the dead from the living parts, notwithstanding there was no sign of an intermitting fever throughout the whole course of the disorder, and even although the gangrene arose from an external cause: and what is most remarkable, while the bark was exhibited in its proper quantities, and at proper intervals, every thing succeeded happily; but, upon intermitting its use, an alteration of all the symptoms was soon made for the worse; and again, upon returning to the use of it as before, the former happy effects followed. But yet there are two cases related in the same transactions, from whence it appears that the patients were lost, and the gangrene not entirely conquered, notwithstanding the use of the bark. The one case was of a dropical patient, when the legs were scarified, to discharge the collected lymph; whence a mortification followed, which was stopped by the use of the bark: but then the patient was destroyed by an incurable jaundice; for being exhausted by the disease and evacuating

^a Philosoph. Transactions, n^o 426. p. 429. et 434. Abridgment, Vol. VII. p. 643—652.

cuating medicines, a gangrene invaded the other leg, and proved fatal. The other case observed was in a man of fifty years old, who by a cachexy from too plentifully drinking of wine, had a phlegmon in the toes and insteps of his foot, which degenerated into a mortification. Many remedies were used both externally and internally, but without success: for the mortification spread daily, accompanied with a slow fever, and a copious discharge of very limpid urine; till at length two scruples of the bark were given every four hours: but although the use of this remedy was continued for several days, yet the mortification and copious discharge of urine continued, and the patient expired in a fortnight's time.

There are many more cases, which prove the efficacy of the bark in the curing of gangrenes and mortifications, related in the *Edinburgh Medical Essays* ^b. But as gangrenes frequently, and mortifications sometimes, happily stop, even in old people, without the use of the bark, so as to procure a happy separation of the dead from the living parts, and complete the cure, as I have sometimes seen; it is not as yet in my power to determine any thing in this respect from my own experience: but the thing is certainly of so much importance, that no one ought to omit the opportunity of trying what the bark can effect in these disorders.

§. 448. **T**HE incised or scarified parts (446) are to be fomented with warm liquors resisting putrefaction (438,) and the hardness of the eschars (389) is to be softened by the use of emollients (403.)

In order to make a separation of the dead or gangrenous from the living parts which adhere together, it will be very proper to mollify and moisten the gangrenous crust to such a degree as that it may almost appear in a fluid state: But in doing this there is always danger of putrefaction; and therefore such things

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ought to be applied which have not only the power of mollifying, but which also resist putrefaction. Hence therefore, when the gangrenous parts are fomented with alcohol or spirit of wine camphorated, the putrefaction is indeed by that means prevented, but then all the parts are hardened; and when those spirits penetrate into the living parts through the deep scarifications, they occasion the living parts also to mortify, and by that means produce a new gangrenous crust. But when these parts are cherished with emollient fomentations, that which is dead and incumbent upon the scarified part is so relaxed and loosened, that it hardly any longer coheres to the living vessels, and may therefore be very easily separated by the force of the vital humours impelled through the yet living vessels. In the *Materia Medica* corresponding to this aphorism, we are furnished with a liquor or fomentation of this nature, which very strongly resists putrefaction; and in the same place there are also some forms of cataplasms serving to mollify the gangrenous eschars. It is usual with surgeons to sprinkle some antiseptic liquor upon the parts before the application of these cataplasms, and thus they very well combine the assistance of these two remedies together. A simple cataplasm for this purpose may be composed of the meal of oats or rye, which soon turns sour, boiled in skimmed milk; adding towards the end some green rue bruised, and a small quantity of sal-ammoniac, with a little linseed oil, or some other oil, to prevent the cataplasm from drying and hardening upon the part.

§. 449. **M**ORTIFIED parts which hang loose, or which are separated from the rest, are to be removed either by the pliers or scissars after the gangrenous eschars are mollified.

During the application of the forementioned remedies, the gangrenous eschars divided by scarification begin to dissolve and separate from the living parts, in such a manner that they adhere only in a few points: and when surgeons are over diligent to keep the parts clean,

clean, they pull off these portions of the gangrenous eschars with their pliers, with no small pain to the patient; insomuch that they sometimes excite a convulsion or cramp in the tendinous parts, by irritating or pulling the mucous capsules of the tendons, as is evident from the medical and chirurgical observations alleged in the commentaries on §. 164. How prejudicial, and even cruel, it is, to cut or pull off dead parts before they have been mollified, while they strongly cohere with the living, was observed before in the commentary to §. 444. Nature, who is so frequently of herself sufficient in the cure of diseases, will perform the separation of the dead from the living parts which she has once begun: And therefore all that art has to do, is, to procure healthy juices to flow through the living vessels in a due quantity and with a due impetus, by supplying the patient with a proper diet and medicines, so that by the continual struggle of the vessels the gangrenous eschars may be repelled after they are mollified and relaxed by the use of cataplasms and fomentations; restraining at the same time the putrefaction which might be feared by the use of antiseptic medicines. But whatever parts appear loose, and free from cohesion with the living parts, ought to be removed; lest, by remaining too long upon the part and putrefying, they should corrupt and injure the subjacent tender vessels: Or if any portions of the gangrenous eschars are pendulous, and adhere but by a small part, they are to be cut off with a pair of scissars, leaving that part behind which as yet adheres to the living vessels; for by pulling such parts forcibly off from the living vessels, a fresh bleeding wound is made, which may be much injured by the gangrenous or putrid matter, since that matter may be easily absorbed by the open mouths of the lately divided vessels. It may be therefore taken as a general rule in this case, Not to take off any part which will give pain to the patient, or occasion a free bleeding in the removal.

§. 450. **T**O the whole affected part warm cataplasms are to be continually applied, and

and constantly kept in action by administering an external warmth or heat; which cataplasms may be composed of emollient, diaphoretic, and anodyne ingredients.

Since the vital humours have no motion through the gangrenous parts, that heat which results from motion will be wanting in them; and therefore this deficiency is to be supplied by an external warmth. But it is very evident that this external warmth is to take place only when the gangrenous eschars are of a considerable thickness, for otherwise the heat of the subjacent living parts will be sufficient. In these cases, therefore, it is usual to prefer the use of cataplasms rather than fomentations: because the former retain their heat longer, and are not so soon dried up, whence they do not require to be so frequently renewed; and they may be commodiously retained warm by the application of those hot bricks or tiles which we mentioned before. But in those cataplasms there is also required an emollient force (as was said on §. 448), joined with such things as restrain putrefaction, and gently stimulate the living vessels by their agreeable spicy nature (§. 435, n° 2.) These remedies are therefore to be various according to the different nature of the affected parts. For if they appear dry, emollient and moistening remedies will be chiefly serviceable; but, if there are signs of a violent putrefaction, antiseptic medicines will be more plentifully required. If a paleness, coldness, and weakness, prevail throughout the whole body, or in the affected part, it will be proper to use a larger quantity of stimulating spices; and, on the contrary, if a violent inflammation appears round the margin of the gangrene, it will be of more service to use elder-flowers, house-leek, and other proper coolers. But it is usual to add anodynes to these cataplasms, in order to obtund and mitigate the sense of pain, which is often very severe and troublesome during the separation of the gangrenous eschars from the subjacent living parts. For these eschars adhere to the living and sensible parts in an infinite number of points; and therefore, as they gradually

gradually contract and shrink in all their dimensions, there is a slow distraction or laceration of the sensible nervous fibres in the living parts which adhere to the surface of the gangrenous eschar; from whence pain arises (220, 221.) From hence therefore it is again evident how useful emollient and relaxing remedies are in this case, since they occasion a more speedy separation of the gangrenous parts, and at the same time mitigate the pain which arises from the distension of the nervous fibres, as we proved before in the commentaries on §. 228, n^o 1. At the same time may be added to these cataplasms such things as diminish the sense of pain while its causes continue, such as the hen-bane and the nightshade of the shops, &c. But in the *Materia Medica* corresponding to this aphorism, we are supplied with the form of a cataplasm for this purpose.

§. 451. **T**O this purpose, also, a seldom uncovering of the parts will conduce more than is commonly imagined.

How speedily a gangrene or mortification sometimes spreads, has been before demonstrated by the the most faithful medical and chirurgical observations; and therefore it is a custom with some surgeons to open and inspect the gangrenous parts upon every occasion; and this with some justice, while the gangrene has not yet appeared to have stopped in its progress. But after that fissure or division which separates the dead from the living parts, has appeared all round the gangrene, and fixed the bounds of the spreading disorder beyond which it cannot pass, there is then no danger even tho' the cataplasm be suffered to continue a long time upon the parts without being renewed, since the continuity of the dead with the living parts is now dissolved; for these cataplasms consist of such things as prevent the putrefaction that might be feared, and the gangrenous crusts are by this continual maceration so mollified and dissolved that they easily separate by the mild suppuration which is here so necessary. But when the dressings are frequently renewed, the air has a free admission

sion to the living parts; whence it will be hurtful to the gangrenous crust, as we demonstrated in the commentary on §. 204.; and this more especially when the surgeon keeps the parts a long time exposed, to examine them with his instruments, or clean them, as is often done with too much exactness. It may be sufficient for the surgeon to come three or four times in a day, and endeavour to discern whether he can smell any thing of putrefaction; and if nothing of that nature appears, the dressings may be continued upon the parts for the space of twenty-four hours.

§. 452. **W**HEN all these means (446 to 452) have been used, the eschar contracts, and the scarified parts appear moist; while the edges of the sound parts swell, look red, and tend to suppurate, so that the dead parts begin to loosen; which is a sign that a separation will follow, that a stop is about to be put to the spreading disorder, and that in a little time the parts will be depurated or cleansed.

After the vital humours flowing to the confines of the gangrenous eschars have dissolved the connecting fibres which join the gangrenous to the sound parts, then the extremities of the living vessels are drawn asunder by that force which we explained in the commentaries on §. 158, no. 1.: and in the mean time the gangrenous eschars, which no longer receive any thing from the vessels, are deprived of their more subtiler juices by the warmth of the adjacent parts; whence they become dry and contracted in bulk, receding from the surface of the living parts to which they adhered; and thus is formed that division which separates the living from the gangrenous parts, and at the same time fixes certain bounds to the spreading disorder. But in those places where the living vessels are free from the gangrenous eschars, the perspiration begins to be carried on, and the humours discharge themselves by the open mouths of the vessels; whence a moisture

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then appears in that fissure or division betwixt the parts, and is a good sign of life returning into the parts. But if the gangrenous eschars are divided with scarifications, their bottoms, which were before very dry, soon begin to be moist: but this moisture is easily distinguishable from that which arises from the fomentations or cataplasms applied. For if these are well cleansed off to inspect the part, it will appear quite dry, so long as a separation of the dead from the living parts is not yet begun: on the contrary, there will manifestly appear a moisture in the bottom of the scarifications, if the subjacent living vessels have but in part removed the incumbent dead eschars; which moisture will return again immediately after, be it ever so carefully wiped off. Soon after this appearance, a suppuration begins to be formed: though the matter which is formed in the fissure or division of the dead from the living parts does not appear laudable, but degenerates from the qualities of good matter; and is also at the same time different from the gangrenous or corrupted matter, coming as it were between that and laudable pus. For those humours which are conveyed through the vital and pervious vessels are converted into matter by warmth, stagnation, and the dissipation or absorption of their most fluid parts; but the thin ichor flowing from the gangrenous parts mixes itself with this matter: whence follows what Galen admirably well expresses, as we observed in the commentary on §. 387, viz. That there is a kind of mixed alteration made in the blood, partly from that which is produced preternaturally, and partly from that which is performed according to nature; whence those humours putrefy which are preternatural, while those are concocted which are according to nature: But when either the natural or preternatural causes prevail, there necessarily follows immediately the signs of that alteration or prevalency both in the colour, smell, and consistence of the matter. For, in the beginning of the separation of the eschars, there is a reddish ichor discharged, which by degrees becomes thicker and more unctuous, and in the following days approaches nearer to the conditions

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of laudable matter, till at length it has all the appearances of good pus. And now the margin of the living parts, which are entirely set at liberty from the gangrenous or dead parts, appears perfectly like the lips of a clean wound; and therefore it begins to swell, look red, become painful and hot, &c. for the reasons which we before gave in the commentaries on §. 158, no 5. But all this is performed in the vessels of the living parts which lie under the gangrenous eschars; which are also separated by degrees from those vessels; whence that crust, which before strongly adhered, begins now to feel soft and loose to the touch of the finger, and by a slight pressure discharges round its surface all the humours which were collected beneath; and thus being gradually separated from its cohesion with the living parts, it falls off; leaving a clean wound, with a loss of substance, which requires to be incarned and healed.

§. 453. **T**HEN lenient, anodyne, and balsamic digestives are to be applied; the ulcer must be seldom uncovered; every thing which renders the fibres too rigid are to be avoided; the parts are to be kept at rest; and the disorder treated like a clean ulcer (411.)

After the spreading gangrene is stopped, and the crust or eschar separated from the margin of the living parts so as only to remain by them like an island; we are then to consider the part as a sordid ulcer, which first requires to be cleansed, and then to be incarned and healed: whence Celsus, treating on the cure of a gangrene, justly says, *Afterwards, if the disorder stops, the wound ought then to be treated with the same remedies which are prescribed in a putrid ulcer*^a. Now the depuration of such an ulcer consists in making the gangrenous eschars fall off as soon as possible by the impulse of the vital humours brought by the vessels: And

^a Postea, si vitium constitit, imponi super vulnus eadem debent, quæ in putri ulcere præscripta sunt. Lib. v. cap. 26. n^o 33. p. 304.

And this will be obtained chiefly by such remedies as relax and mollify the gangrenous crusts; for which purpose the soft unguentum aureum, basilicon, or tetrapharmacon (so called from the number of its ingredients), with fresh butter, and the like, are extremely useful. Nor need we fear that the living vessels will, by a use of these emollients, be too much relaxed, so as to degenerate into fungous or proud flesh; for this will be prevented by the incumbent gangrenous crust; and when it is removed, and the parts by that means depurated, such things may be applied as gently corroborate, and prevent too great a dilatation of the vessels. But such emollients are also anodynes at the same time, as explained in the commentaries on §. 450. But if the living vessels which are naked begin to germinate or rise up too much under the gangrenous crust which was separated, that luxuriancy may be taken down by sprinkling on some powder of mastic, while in the mean time the same emollient remedies may be applied to the other parts of the wound. The seldom uncovering or exposing the affected parts to the air will be also of great service, as we observed at §. 451. But all spirituous medicines, such as alcohol, and spirit of wine camphorised, treacle-water, &c. tho' they indeed prevent the putrefaction, do at the same time retard the cure, by congealing the fluids and rendering the solid fibres rigid; and therefore it will be the more difficult to separate the dead from the living parts, since by the application of these the cohesion of the solids will be increased. The same cohesion or hardness of the solids will be also increased by continually fomenting the gangrenous parts with a strong brine of sea-salt, sal-ammoniac, &c.; for it is known by daily experience, that the flesh of animals soaked a long time in brine becomes very hard. What has been already proposed will be therefore sufficient. But then the part ought also to be kept at rest, that the dressings may be better retained, and also that the pulp-like or soft ends of the vessels which are growing up under the eschar may not be compressed and destroyed by the attrition of the hard eschar. What else is necessary to complete
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the cure of a gangrene after all the dead parts have been separated, may be easily understood from the commentaries on §. 411. where we treated of an open abscess or ulcer.

§. 454. **I**F the gangrene arises from the humours impacted by severe frost (427, n° 6.) the vessels are to be opened by the application of snow, or linen cloths moistened in freezing water, until the spiculæ of the cold are received into the snow or water, and the disorder begins to depart by the return of life.

The cure of all gangrenes which take place in any part, would be now finished, if we had not a particular kind of gangrene which arises from intense cold, (422, n° 3.) The diagnostic signs of this gangrene have been enumerated at §. 427, n° 6. But if the cure of this gangrene was to be attempted by the methods already prescribed, the affected parts would be soon corrupted with a perfect mortification, even down to the bone, as is evident from sad experience in the northern countries, where the winter is extremely severe. The greatest care is therefore necessary to distinguish this gangrene from all others; which may be easily done by attending to the preceding cause, and to the present signs.

The schools generally teach, that cold is a mere privation of heat; and therefore many have believed, that the diseases produced by cold may be cured by the application of heat. But if we consider the effects of cold, it will appear to be rather a physical ens, or material being, distinct from all others. Helmont ^b, who always inveighs against the schools, says, that when a young man descends from the Alps of a morning, which are continually covered with snow, he will nevertheless be so much scorched with the sun on one side, that blisters will arise in his neck like those produced by fire: Whence he concludes, that in the same place, at the same time, and in the same subject or medium (that

^b Ortus Medicin. in capit. *Natura contrariorum nescia*, p. 135. n° 23, 24.

(that is, in the air), there resides so much heat as is sufficient to raise the skin into blisters, and also so much cold as is sufficient to prevent the snow from melting by the heat of the sun; and therefore that it is possible for heat and cold to exist together, though they do not destroy each other. Hence he thinks it is evident, that cold is not a privation or absence of heat, but a true and distinct being. If we consider what happens in the artificial freezing of liquors, it will be sufficiently apparent, that cold has very wonderful properties, and may pass out of one body into another, and by that means may be greatly increased, when, for example, in a very cold body there is more cold added continually. Hence the acute philosopher Reaumur^c, to whom we owe many and great discoveries, has compared this property of cold to that of fire, with which we are so well acquainted, and from a very small spark of which received by inflammable matter the most intense degree of fire may be produced. But as actual fire is required to produce more new fire in this manner; so also ice, being once formed, will produce more ice when mixed with certain salts, &c. by which means the cold of ice may be greatly augmented in the midst of summer. Water by a certain degree of cold loses its fluidity, and is then called *ice*; in which ice there is something capable of passing out from thence, and of entering into other bodies which are contiguous, whether they be solid or fluid. For if (for example) ice, having only that degree of cold which is required to prevent it from melting into water, be mixed with sea-salt, the cold is greatly increased^d; and, as we are taught by observations, that cold is increased only when the ice begins to melt: If, then, into such a mixture of ice and sea-salt you immerse a vessel full of water, that water will be converted into ice which appears much colder to the thermometer than the first ice itself with which the freezing mixture was made by adding sea-salt. Thus by repeated freezings, or mixtures of sea-salt and ice, the cold may be augmented to an immense degree, as is evident from those
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^c Académ. des Sciences, l'an 1743. Mem. p. 228.

^d Ibid. 252.

fine experiments which are given us in the Memoirs of the Royal Academy in the place which we lately quoted. Now these properties of cold being known, may perhaps afford some light into the effects which are observed from it in parts of the human body which have been exposed to the injury of severe cold. The heat of our bodies, when in health, exceeds that of the ambient air even in the hottest time of summer; from whence it is evident, that a very considerable degree of cold is required before it can be able to freeze or stiffen the soft parts of our bodies: but since (*ceteris paribus*) our heat is always less in the extreme parts, because the celerity of the blood's motion through the vessels is most diminished at the greatest distance from the heart, therefore the cold of the ambient air is observed to produce its effects mostly in the fingers and toes, ears, and end of the nose. But since, by frost, water, which was before fluid, is converted into rigid spiculæ; so also may our humours, which contain in them a large quantity of water, be affected by it in the same manner. Therefore all the influx and efflux of the humours through the vessels must be stopped by the freezing cold, which destroys the fluidity of the humours, and turns them into solids; whence a gangrene must follow, as is evident from the definition given of it at §. 419. But since these congealed spiculæ of the humours are seated in the smallest and most tender vessels, it is very evident, that if those vessels are suddenly moved by the application of heat, frictions, &c. they must be all destroyed. For even if we suppose these spiculæ to be in part dissolved by that means, and the circulation to be partly restored, all parts of the humours which are not yet reduced to a perfect state of fluidity will stagnate and obstruct the narrowest parts of the vessels; and since the impetus of the vital humours acting behind these obstacles will protrude them forward, such rigid and sharp-pointed spiculæ must necessarily soon destroy the continuity of the small vessels, so as to render the disorder in a little time totally incurable, nothing more being in the power of art than to procure a separation of the dead and corrupted

rupted from the living parts. But perhaps these mischiefs may be still increased, since the saline particles of our humours are sharpened by freezing, and combined into grosser particles, which being put in motion before they are reduced to a state of fluidity, must by their rigidity, weight, and sharp-pointed figure, prove extremely hurtful. At least this is evident from experiments, that water saturated with salt will not freeze but by a greater degree of cold; and it also appears, that, before freezing, the salt is deposited from the water, and collected at the bottom of the vessel.

We are taught by the observations which have been frequently made in the coldest countries, that these disorders are best cured by applying cold water to the frozen parts, when the water itself is near freezing; for then that physical cause which turned the particles of the fluids into rigid ice, is from thence extracted and transferred into the contiguous water. By this means the juices are restored to their former state of fluidity; and may be then safely put in motion by cordials, frictions, and stimulating medicines. Thus Hildanus^c tells us, that the inhabitants of the more northern countries first rub their hands, ears, and nose with snow of an evening, before they return to their houses or approach the fire. And he further relates, from a man of indisputable credit, that a certain traveller, who was frozen in his journey, being brought in a manner dead to the inn, the inn-keeper immediately dipped him in cold water; by which means the freezing spiculæ were drawn out on all sides in such a manner, that the whole body appeared incrusted over with ice. After this, by exhibiting to him a large glass of mead, with powder of cinnamon, mace, and cloves, he was put into a sweat in bed; by which method he recovered, though with the loss of his fingers and toes.

§. 455. **F**OR otherwise, by the application of heat, the part corrupts or mortifies,
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^c De Gangræna et Sphacelo, cap. 13. p. 792.

from the spiculæ being put into motion without being extracted.

For when that physical cause which produces the freezing of the juices is not removed; by putting those icy spiculæ into motion by external heat, all the tender vessels and fibres are destroyed. This is very evident in frozen apples: For if these be suddenly applied to the fire in order to thaw, they lose all their taste, and are in a little time corrupted into a soft pulp: but if they are dipped into very cold water next to freezing, they will soon be covered over with a beautiful crust of ice; which being scraped off, will arise again by immersing the apple a second time in the same water; and this to be repeated till no more ice is observed to proceed from the apple; which being then wiped dry, will afterwards keep a long time, and retain its natural taste. The same thing happens in the parts of the human body affected by extreme frost; for if such parts are imprudently exposed to heat before the freezing spiculæ have been drawn out by the application of snow or cold water, they soon corrupt, and, mortifying, fall off from the living parts. This seems to have been intended by Hippocrates when he says, *But also the feet, when rendered extremely cold, fall off by the affusion of warm liquors*^a.

§. 456. **B**UT when this (445) has been premised, the patient is to be recruited with warm cordials, and to be heated even into a sweat.

After those freezing spiculæ have been extracted, there is then no longer any danger of wounding and destroying the soft parts by putting them into motion, so that it may be very safe to give such things as excite the juices to a greater motion, and diffuse an equable heat throughout the whole body, as well as through the part affected. For by this means the circulation of the juices will be more speedily restored to those parts;

^a Verum et pedes perfrigerati deciderunt ex calidæ affusione. *De Libidinum Ufu, cap. 1. Charter. Tom. VI. p. 444.*

parts, in which they before perfectly stagnated. Hence Hildanus ^a recommends gentle frictions; and then advises the use of fomentations of the leaves of laurel, rosemary, sage, lavender, &c. boiled in new milk; and, after putting the patient to bed, to apply some warm sudorific medicines to the affected parts, so as to determine the increased motion of the humours chiefly towards those parts. Forms of these medicines may be seen in the *Materia Medica* corresponding to the numbers of these aphorisms: and in poor people, labouring under this misfortune from the severity of the preceding winter, I have frequently seen plentiful drinking of an infusion of saffraſas to be very serviceable; which is a medicine extremely cheap as well as efficacious.

Of a MORTIFICATION or SPHACELUS.

§. 457. **I**F a gangrene is already converted into a sphacelus or mortification, the corrupted part is to be then removed from the sound.

What a sphacelus or complete mortification is, was said before in the commentary on §. 420. and the signs of that disorder being present were enumerated at §. 429. and from thence it is evident that no other method of cure can be attempted than by removing those parts which have been already corrupted by the sphacelus. It is true, that in an incipient gangrene there were some hopes of conquering the disorder by the timely application and efficacy of the proper remedies (441.); but when all the parts are mortified down to the bone, life can never be restored again into those parts: Therefore there remains but one curative indication; namely, To procure a separation of the dead from the living parts, either by nature or art. The surprising history related in the commentaries on §. 429, n^o 4. concerning the old woman whose mortified leg was preserved for many months by spirit of turpentine,

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^a De Gangræna et Sphacelo, cap. 13. p. 793.

demonstrates that a putrefaction may be so restrained in a dead part exhausted of its juices, as to preserve it from corrupting or dissolving into matter; but yet this does not cure the sphacelus, which always requires a separation of the dead from the living parts. Even in the places now cited, and in such a decrepid age, we find that nature attempted a separation of the dead from the living parts: for after the patient had been confined to her bed for the space of six months, a considerable fissure or division appeared spontaneously in the confines betwixt the dead and the living parts; but a perfect separation of the corrupted parts in such an old person could not be expected, and therefore death followed soon after. But, in healthy people of a middle age, the sphacelated parts separate spontaneously, as we are taught by the observations instanced in the commentaries on §. 432. Physicians therefore, and surgeons, follow the dictates of nature, when they endeavour to remove the sphacelated parts as soon as possible, provided the patient is in a condition of supporting the means necessary to such a separation, and there are hopes of completing the cure after that separation has been made. For although, in extraordinary cases, the parts corrupted by a sphacelus have spontaneously separated; yet it is much more frequent for the disorder to spread and prey upon the adjacent living parts: whence it seems to be much better, and more safe, immediately to amputate the mortified part, that it may not spread through the living. But when a sphacelus makes no advances, it may be then proper to wait a few days, to see what can be done by the salutary endeavours of nature overpowering the disease; provided antiseptic remedies are in the mean time applied to the affected parts, to preserve them from any manner of putrefaction; and this more especially if the affected parts are of that nature as not to incur much damage although the sphacelus should make some progress into them: as for instance, if the lower part of the foot should be sphacelated, one may safely wait thus several days for a separation, provided the mortification does not ascend very fast, since an amputation

tion ought to be always made in this part under the knee, as we shall declare hereafter in the commentaries on §. 468.

§. 458. **B**UT this removal of the corrupted parts is to be effected different ways according as the member is either wholly or but partially affected, or according as the nature of the part either will or will not admit of the mortified parts to be totally removed, as in the nates, &c.

Since we ought always to preserve the sound parts as much as possible at the time of removing those which are corrupted, as we shall hereafter declare at §. 467, it is very evident that this will occasion a considerable difference in regard to the cure, according as any limb, for instance the arm, is corrupted either wholly or but in part. Besides this, an extirpation, properly speaking, removes all that is corrupted; which can take place only in the extreme parts of the body. Hence, for instance, when a mortification arises about the os sacrum and coccygis by too long lying upon those parts in any chronical disease, it is evident that the situation of those parts will not admit of amputating all that is mortified, together with the bones, which are frequently themselves affected. The same is also true in mortifications from the same cause about the prominent parts of the vertebræ of the spine and scapulæ of the shoulders, with the larger trochanters of the thigh-bones, &c.

§. 459. **I**F therefore the part is not wholly corrupted to the bottom, or if it cannot be extirpated, we are then to endeavour, 1. To stop the progress of the mortification; and, 2. To remove that which is already corrupted.

It sometimes happens, that the panniculus adiposus is distended with a gangrene to an enormous bulk, and all the subjacent parts are imagined to be mortified even down to the bones, when at the same time life in

some measure often remains in those parts, so that, by setting them at liberty from the incumbent dead mass of the panniculus adiposus, life has perfectly returned into the limb, when nothing but amputation was thought of. A wonderful case of this nature is related in the commentaries on §. 338, confirming what has been said. For although the anterior part of the cubitus, and whole hand, in that case, appeared cold and pale after a violent contusion, and even no pain was perceived by deep scarifications, nor so much as a drop of blood discharged by passing a lancet through the hand; yet life and warmth gradually returned into this part, which seemed to be perfectly dead. There was a woman many years ago in our hospital of Leyden, who had a very bad mortification about the os sacrum from lying in bed; which not only corrupted the integuments, but also rendered a large part of the surface of the os sacrum itself black or foul; and when our celebrated professor Boerhaave, who had the care of her, almost despaired of curing so great a malady, the corrupted or foul scales of the bone began to exfoliate, and the living bone underneath sent out vessels which renewed the periosteum, and thus so great an evil was happily brought to heal and cicatrize. When therefore there are any hopes remaining that all the parts are not yet corrupted, or when the nature of the part is such as forbids the extirpation of it, two indications arise; namely, to prevent the mortification from spreading into the adjacent living parts, and then to procure a separation of such parts as are already corrupted.

§. 460. **T**HE spreading of a mortification is prevented by cutting off the communication betwixt the dead and living parts.

In the part once mortified, all the humours stagnate in their vessels, or else they stagnate after extravasation when the vessels have been ruptured. But so long as the continuity is maintained betwixt the dead and the living parts, the juices brought by the living vessels will be stopped immediately when they reach the part

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where the sphacelus begins; so that the circulation will be impeded in the living parts adjacent to those which are dead, and the disorder by that means propagated or spread farther. Nor can this be prevented unless by removing the cohesion of the dead from the living parts; which so soon as it is performed, either by nature or art, causes an extravasation and discharge of the humours from the living vessels, the extremities of which contract: whence a fissure or division is made, separating the dead from the living parts; and then the mortification spreads no farther, even notwithstanding there are several causes concur which very much favour the spreading of the disease. This may be confirmed by a very remarkable case of a soldier, who, being guilty of theft, to avoid punishment, threw himself from the walls of a castle, by which his feet came with so much violence against the stones, as not only luxated them, but occasioned a fracture with a wound in each. As there were but few soldiers in the place, they had no surgeon: so that the unfortunate patient was obliged to lie upon straw, without any assistance, for the space of four months, living merely upon bread and water; whence it was no wonder that first a gangrene and then a sphacelus invaded each foot. However, in this calamitous state of the case, a separation was made of the dead from the living parts above each ankle; and about those parts the living vessels formed a protuberant ring, which restrained the mortification in such a manner that it could not spread any farther, notwithstanding all below that ring was destroyed by a malignant putrefaction, exhaling such an intolerable smell in the hottest season of the year that it infected the whole castle, whence they were obliged to convey him to the hospital of the next adjacent city. The miserable patient had cut off his right foot himself with a knife, in the articulation of it with the tibia and fibula, without feeling any pain, or losing any blood; and when he was brought to the hospital, a great part of his left foot was also separated; and although he filled all places whither he came with an intolerable smell as of the most putrid carcase, yet the mortification did
not

not transgress the bounds or separation which nature had placed betwixt the dead and the living parts. And as the ends of the tibia and fibula were quite exposed and corrupted, an amputation was made in each leg, and the soldier afterwards cured in a little time^a. Hence therefore it is evident, that the progress of a mortification will be stopped by cutting off the communication betwixt the dead and the living parts.

§. 461. **T**HIS communication is cut off by fixing bounds or limits in the sound parts, parting them from those which are dead or corrupted, either by incision, cauterization, or corroding with caustics; taking care that they penetrate on all sides to a sufficient depth.

Thus art, in imitation of nature, endeavours to place a boundary to prevent the progress or communication of the sphacelus with the living parts: but this can never be so well performed by art, as we observe it is by nature; who procures a perfect separation of the corrupted from the sound and living parts, and at the same time preserves the latter free from injury. But when this is procured either by the knife or fire, there are always some of the mortified parts left, or else some of the living parts destroyed at the same time. It was proved in the commentary on §. 444, that the impulse only of the vital humours, in the confines betwixt the dead and the living parts, dissolved their cohesion, and procured a mild suppuration so as to occasion all that was corrupted to fall off. Now in making this boundary by the knife or cautery, these must be applied not in the *living*, but in the *dead* parts, though as near the former as can be done with safety and convenience: for since in this case the parts are not yet supposed to be corrupted down to the bottom, or the condition of the parts is such as admits not of extirpation, it would be cruel to make the separation in the living parts, so as to destroy them, and excite the most intense pains, in-

^a Bellôste Chirurgien d'Hopital, partie 3. chap. 15. p. 262, &c.

inflammations, &c. especially when these remedies are to penetrate to a considerable depth in a mortification. It is indeed true, that, in this separation, some of the dead part is left adhering to the living; but yet that which is corrupted will no longer injure the sound parts, since it may be so preserved by the application of antiseptic remedies as to prevent all putrefaction. When limits are thus fixed by art to the spreading mortification, and the remaining part or surface of the sphacelus is divided with deep scarifications, the applied remedies will then penetrate more deeply; so that there can be no danger of a putrefaction, and a perfect separation of the dead from the living parts may be safely expected, which can be only produced by nature. Bounds may be in this manner prescribed to a mortification either by incision, or by cauterisation with the actual cautery; as also by the application of those caustic liquors which in a moment destroy the parts within their contact, such as the solution of mercury in aqua-fortis recommended by Belloste, (see the commentary on §. 444), or the butter of antimony so much recommended by others, especially after it has been reduced to the state of a limpid liquor like water by rectification; for then one may be able to prescribe limits in this manner at pleasure to every sphacelus, by dipping a pencil-brush in that very sharp liquor. But this last remedy is recommended in these cases the more especially as it is composed of a very concentrated spirit of sea-salt, united with the reguline parts of antimony: and spirit of sea-salt is well known to be an incomparable remedy to correct and restrain any manner of putrefaction; whence it is so successfully used in the cure of a gangrene in the gums, as we observed before in treating of the remedies for that disorder. But, as we have before often observed, this method does not produce a separation of the living from the dead parts, but only prescribes bounds betwixt the sphacelus and sound part; which bounds or margin is itself a dead substance, and must be afterwards separated; but yet in the mean time it intercepts the communication betwixt the dead and the living parts. Celsus
has

has very well remarked the efficacy of corroding medicines, when he says, in treating of the cure of carbuncles, *For there is a crust formed under the caustic remedies, which being separated on all sides from the living flesh, takes off with itself whatever was corrupted, &c.*^b For here he well remarks, that a dead crust is indeed formed by caustics, but that it must be afterwards separated from the living parts; and this separation, therefore, does not result from the power of the caustic, the action of which is vanished long before this separation is effected by nature.

§. 462. **T**HE corrupted parts will be separated, if, after having stopped their spreading (461), or at the time this is performing, the whole corrupt part be cauterized or else incised down to the living parts, and then consumed by the application of caustics, till the whole is removed in the form of eschars, which are to be continually softened and taken off (403) till the parts appear clean and sound; carefully avoiding to injure the living parts.

Since a sphacelus or mortification is said to be present when all the parts are corrupted to the bone (§. 420.) all those corrupted parts ought to be removed as soon as possible, that they may not infect the living vessels in the bone or in its periosteum. But the parts injured by a sphacelus are completely mortified, consequently no more affected with the application of remedies than a dead body; and therefore they ought to be removed either by the knife or fire, or else by the application of such caustics as by external warmth are capable of acting upon a dead body. For Petit^a has demonstrated, that the potential cautery of the surgeons, applied to a dead body, scarce produces any effect, even though it remains upon the skin for the space of fifteen hours,

^b Sequitur enim sub medicamentis erodentibus crusta: quæ undique a viva carne diducta, trahit secum, quidquid corruptum erat, &c. *Lib. v. cap. 28. n^o 1. p. 316.*

^a Académ. des Sciences l'an 1732. *Mem. p. 315.*

hours, dissolving or melting as it usually does when exposed to the air. But when he continually fomented the dead skin by the application of warm linen cloths, he found, that, within the space of fifteen hours, the skin of the dead body to which the cautery was applied was by that time reduced to a soft pulp, and the force of the medicine had penetrated through to the fat. The common potential cautery therefore of the surgeons, which is made of pot-ash and a lixivium of quick-lime inspissated together, may be applied with good success for removing the dead parts of a sphacelus; or, instead of that, the lixivium itself may be used; and, if the warmth of the adjacent living parts is not sufficient to excite its action, an external heat may be applied: and thus may the dead parts be in a little time reduced to eschars; which being mollified with some soft ointment, or the application of butter, may be easily removed or taken off. Then the same remedy may be applied again in the like manner, till all the dead parts are by that means consumed, down to the living or sound parts. But as in every sphacelus there is always danger of a putrefaction, therefore corrosive acids might seem rather more convenient than the lixivium of quick-lime and fixed alkaline salts, which immediately render the salts of our humours volatile and alkaline as in a state of putrefaction. But if it be considered that a sphacelus or mortification penetrates into the bones, and that those strong acids are always injurious to the bones, it will readily appear why we ought to abstain from the use of acid caustics. Thus it is usual with strumpets to rub their teeth with spirit of vitriol, which for the present makes them look white, but after a few weeks they begin to turn yellow, and at length they become black, and drop out in pieces, the acid of the vitriol having destroyed their vessels or vital fabric. Hence, therefore, to fix the bounds betwixt the dead and the living parts in a mortification, that strong acid or concentrated spirit of sea-salt, contained in the butter of antimony, is preferable to any other: but then to separate and convert the dead parts speedily into eschars, the very strong alkaline

caline lixivium will be rather more conducive. But when the soft parts are so consumed that some infection appears in the bone itself, as may be readily perceived by the change of its colour; then those things ought to be used which we recommended in wounds of the head, that is, when the bones of the skull itself were hurt. See §. 249, to 254.

But as all these remedies are extremely acrid, and destroy the parts which they touch almost in an instant; it is evident that the greatest caution is necessary, in using them, not to destroy the living together with the corrupted or dead parts. And because in a true sphacelus there is often no more of the living parts left than the periosteum and the bone itself, therefore an imprudent use of these caustics might easily damage the last, so as to render the cure afterwards extremely difficult and tedious, since the separation of the corrupted or dead parts in a bone does often take up a long time in the cure, as we shall afterwards explain more at large in treating of the diseases of the bones. Besides this, when such remedies penetrate deeply into the subjacent parts, they may injure and irritate the tendons, nerves, membranes, and other adjacent tendinous and living parts, from whence again the worst consequences may follow, as we observed at §. 163.

It is also to be observed, that this destruction of the dead parts by caustics is not necessary but when they are very thick, for otherwise the cure may be very well performed without them. Thus when a sphacelus arises about the os sacrum and coccyx from long lying on the back, the dead parts usually look black and are dried up like leather; and as the panniculus adiposus is here very thin, such caustic remedies cannot be applied without danger of injuring the subjacent bone. But when the parts are in this case fomented with wine, vinegar, and salt, and afterwards covered with a simple diapalma or leaden plaister, while in the mean time the patient changes the posture of body, retaining the fæces and urine with which those parts were before injured; the violence of the mortification then lessens, all the dead parts spontaneously separate, and a happy cure

cure follows, as I have frequently observed, and which was also mentioned in the commentaries on §. 444.

§. 463. **W**HEN after this the signs of health and life returning appear in the parts, they are to be then treated as a wound or ulcer.

When the vital influx of the humours by the arteries, and the efflux of them by the veins, is totally abolished; then a death of the part is said to be present, (see §. 419): and therefore the signs of life returning will be such as denote the humours to flow into the parts again by the arteries, and from them by the veins; that is, denote that the circulation of the humours is restored, or at least begins to be restored. But this restitution is never performed in those parts which are corrupted by a true sphacelus, but only in the subjacent or ambient parts. If therefore, by scarifying or corroding, you remove the dead and corrupted parts, or else divide them with a knife down to the living parts, a moisture will then begin to appear in those parts which before looked dry, and a separation will be made of the dead from the living, in proportion as life prevails or returns, as was said before more at large in the commentaries on §. 452. Then there is no longer any danger lest the sphacelus should spread, but the part may be considered as a sordid ulcer, which, after being depurated from its foul or corrupted parts by a mild suppuration, is to be reduced to the state of a clean wound, and then treated or cured as such. But it must be observed; that after the parts are cleansed, the softest balsams will be useful, in order to restore the lost substance as much as possible; concerning which, see §. 190 *et seq.*

§. 464. **B**UT if the part mortified is some of the extremities, and the sphacelus continued even to the bone; if it can be removed without destroying the patient's life, the part ought then to be amputated together with the bone itself,

self, because the bone being once bare can neither live nor be nourished by its vessels.

The method which has been already explained, takes place only in those parts of the body in which the part affected cannot be totally removed, or in parts which are not yet totally corrupted. But when all the soft parts are mortified down to the bone in some of the extremities of the body; nothing then remains, as we said before, in the commentary on §. 432, from Celsus, but that severe but only remedy, namely, To amputate the member which by degrees mortifies, that we may preserve the rest of the body sound. For if, for example, the arm is sphacelated to the bones, of what service can it be to corrode and destroy the corrupted soft parts by acrid lixivial caustics until the bones are laid bare, when those very bones deprived of all their incumbent parts must necessarily corrupt, and the limb itself become of no use? But when the incumbent soft parts are mortified about the os sacrum and coccyx by long lying upon the back, the case is then otherwise: for the bones are then only uncovered of their integuments, while they continue sound in every other part, and receive nourishment by the living vessels of the lateral and subjacent parts; whence life may be easily maintained in these bones, and even a regeneration of their lost substance produced after their corrupted or foul parts have been cast off. But although it appears, by some extraordinary cases, that the sphacelated parts have sometimes separated, and nature has performed the cure without any assistance of art; yet it cannot be from thence concluded that an amputation is not necessary when a mortification is seated in the extremities. For it is a general rule to be observed, That the sound parts are to be preserved as much as possible: But a sphacelus left to itself spreads and destroys the adjacent parts; and even, before it stops, often ascends so high, that the amputation cannot be performed but with the utmost danger, when it might have been put in practice before with much more safety. See what has been said in the commentaries on §. 432, where we treated concerning

cerning that practical rule which determines a sphacelus to be immediately extirpated; for in that place we have considered this matter more largely.

But it ought first to be carefully considered, whether we may hope to preserve the patient's life after the mortified part has been amputated; for if the sphacelus arose from a latent internal cause in a weak or old patient, and makes a quick progress, it is evident enough that no good can be expected from the amputation, which is then usually rather turned to reflection upon the art and artist. And if the following rule of Celsus takes place any where, it must certainly be of force in the present case, namely, That it is the part of a prudent surgeon not to meddle with what he cannot preserve, that he may not incur the blame of killing the patient, who was killed by his own incurable disorder^a. Indeed the amputation of any of the extreme parts of the body is not without danger, even though it be performed in the most dextrous and artful manner, and in a person who is well in other respects. *But here it will be of no service to consider whether that remedy is sufficiently safe which is the only one remaining*^b. These are the words of Celsus, treating on the extirpation of limbs corrupted by a gangrene or mortification. But this at least is necessary, not to perform the operation, unless it plainly appears that we may hope it will happily succeed.

§. 465. **T**HIS extirpation in the fingers or toes, and in the metatarsus or metacarpus, is performed with a chissel and mallet.

For in these parts the bones to be divided are but small, and may be easily cut through by this instrument with one stroke: But the only danger is, of splintering or splitting the bone by the violence of the blow, which may afterwards render the cure difficult. I must, however, confess that this method of amputation suc-

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ceeded

^a Lib. v. cap. 26. n^o. 1. p. 283.

^b Verum hic nihil interest, an satis tutum præsidium sit, quod unicuique est. Lib. vii. cap. 33. p. 497.

ceeded very happily in the middle of the second bone of the great toe in the left foot of a woman. But in that case, the toe was placed upon a very soft piece of wood; and the chissel or wedge was extremely sharp and strong, and was forced through the bone by one stroke of a leaden mallet. I must needs believe this operation to be sufficiently safe, when made with these precautions; for the blow, though strong, has its violence much qualified by the leaden hammer being little or nothing elastic above, while the resistance below is only very soft wood, from whence there will be no great danger of splitting the bone in making the division of it. But when surgeons cut off fingers and toes by the cutting forceps, however sharp ^a, there will be much more danger of splitting the bone: for this method cannot be performed but by the most violent pressure; which does not like the former act instantly or all at once, but successively and by degrees. But there are many surgeons of the greatest repute, who rather chuse to cut off fingers and toes in the articulation, by dividing the ligaments and other incumbent parts by a very sharp knife, by which means they extirpate the mortified part without offering any injury to the bone. Dionis ^b prefers this method to all others; as likewise does Garengeot ^c, who has also delivered the cautions necessary to be observed in this operation. Hildanus ^d also condemns the amputation of fingers and toes by cutting pincers, as also by the chissel and mallet. This method of amputation is certainly simple enough, if only a finger or toe is to be taken off; but when one of the metatarsal or metacarpal bones is to be also removed at the same time, or when the whole finger or toe is to be taken off in its articulation with the metatarsal or metacarpal bone, it is then more complex, since the lateral fleshy parts must in that case be divided, as is sufficiently evident. In that case, therefore, the operation cannot be performed by one cut with the knife; for which reason Hildanus describes a
sort

^a Schultet. Armament. Chirurg. p. 45.
 Chirurgie. demonstr. 8. p. 498.
 Tom. III. p. 430.

^b Cours d'Operations de
 Operations de Chirurgie,
^c De Gangræna et Sphacelo, cap. 16. p. 800.

sort of a scraper, or rather a very sharp wedge, by means of which the finger or toe may be amputated at one incision, together with part of its metacarpal or metatarsal bone. The figure of this instrument may be seen in his treatise of a gangrene and sphacelus^c. Cabinet-makers use a chissel of the same kind, only less, to work their carving.

§. 466. **B**UT in the larger limbs, as in the leg and thigh, humerus or cubitus, a more ample and operose method is to be used for extirpating the part, which may be understood from what follows in the next aphorism.

It is very evident that there will be greater danger of splitting the bones by amputating with a chissel and mallet, in proportion as the bones of the limb are larger; so that in the amputation of the larger limbs another method is required. And even experience, or repeated observations, demonstrate that the worst symptoms have followed when the larger limbs have been amputated in this rough manner. Thus Hildanus^a relates, that a certain young man having his left-arm fractured by the bursting of a bomb-shell, a barber-surgeon laid hold of a cleaver or hatchet used for splitting wood, and, applying it to that part of the limb where the amputation ought to be made, ordered some of the by-standers to strike upon it, so that by the great weight of a large wooden mallet the hand was amputated at one stroke: but immediately after, the most intense pains, watchings, and other bad symptoms, followed; from which, however, the patient recovered after a long interval of time; but yet the cure was rendered extremely difficult and tedious by the separation of the splinters, it being almost impossible to induce a cicatrix over the stump. There is another method of extirpating the larger limbs, described by Botallus, which is also performed in a very little time; and this method is likewise described in the Microtechne of Van Horne^b,

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^c Ibid. cap. 19. p. 817.

^a Ibid. p. 800.

^b Microtechne,

who has published the medical and chirurgical works of Botallus, and illustrated them with his annotations. It is performed thus: Two wooden pillars are fixed at bottom into a strong beam; a groove being formed within each pillar longitudinally, and a sharp knife fastened with its edge upwards in the beam, another knife also sliding with a weight along the grooves of the pillars downward, with its edge opposed to the former: thus the upper knife, being loaded with a large leaden weight, descends with a great force through the grooves of the pillars, so as to cut off the limb in that part which is laid over the other knife in the lowermost beam; so that by the force of the weight, or else by a stroke with a hammer, both the flesh and bones are in an instant divided. By this method the extirpation is performed so expeditiously, that the pain continues but for a moment, and for the time seems to the patient only like a spark of fire in the limb; all the parts being thus divided at one and the same instant. But the larger bones, which are hollow, cannot be thus divided without danger of splitting them, as is very evident from the daily practice of butchers, as Schelhammer^c has well observed in treating upon this subject; for when the large bones of animals are thus chopped asunder, either by the cook or butcher, by a very sharp instrument, and with a considerable force, we find that they are never divided perpendicularly and smoothly, but unequally, and that they are also much splintered. Hence therefore this method has been condemned by Hildanus^d and other eminent surgeons after him: but, in younger subjects, this method of amputation may take place more successfully, as Solingen^e observes; because, in the younger age, the bones are softer, and more easily divided, without being so apt to splinter.

But by what method, and with what caution, limbs may be safely extirpated, will be declared in the aphorisms following.

^c De Humani Corporis Tumoribus, Parte II. n^o 56. p. 171.

^d De Gangræna et Sphacelo, cap. 17. p. 801.

^e Manuale Operationen der Chirurgie 4. Deel. cap. 2. p. 263.

§. 467. **T**HE part where the amputation is to be performed, is determined by the following considerations:

1. To preserve as much of the sound parts as possible.
2. To remove very exactly all the corrupted parts by one and the same operation.
3. To restore the remaining part as well as possible to its proper uses.

After it has been determined, by a mature consideration of all the circumstances, that the sphacelated or corrupted part must be amputated; it must then be considered in what part of the limb the amputation ought to be made: and this may be done according to the rules of art, by attending to the following considerations.

1. Since this operation is performed only to remove the dead parts, that they may not injure the living; it is sufficiently evident, that no more ought to be taken off from the limb than is absolutely necessary.

2. For that portion of the dead or corrupted parts which is left adhering to the living parts, may very easily spread the disorder, after the amputation has been performed; when at the same time the whole design of the operation was to prevent the mortification from spreading through the adjacent sound parts. Besides this, the remaining dead parts will require the continual application of those medicines which resist all putrefaction, as we observed before in the commentary on §. 461: and this will make it necessary to remove the dressings frequently, which cannot be safely done soon after the amputation has been performed, for fear of a fresh hæmorrhage; while in the mean time the dead parts would corrupt in a very bad manner, so as to spread the mortification, and either destroy the patient, or at least make it necessary to repeat the amputation, to the disgrace both of the art and artist. But although it is disputed among surgeons, whether the amputation ought to be made in
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the dead or in the living parts; yet all of them agree in this, that it is necessary to remove all that is corrupted at one and the same time: for those who make their amputation in the dead parts, do afterwards destroy all that is corrupted down to the living parts by the actual cautery. It may be therefore asked, whether a part ought to be amputated, but when all that is corrupted can be accurately removed at one and the same time? Certain it is, that a doubtful remedy, in desperate cases, is preferable to certain death; and since the amputation may be made without pain, and almost without any loss of blood, in the mortified part, it therefore seems adviseable to perform the operation sometimes, even when it is not practicable in the living parts.

A very skilful surgeon, confirmed by many years experience in his art, did in this manner perform an amputation which happily succeeded in a case that appeared desperate to all^f. A captain of a man of war having received a violent contusion or crushing of his whole hand and arm up to the shoulder; the evil was exasperated by an ignorant person, who violently pulled and distorted the limb, supposing the humerus to be luxated, insomuch that in four days time the whole arm was corrupted with a true sphacelus, without being the least suspected by the surgeon who had the care of the patient; and even the mortification had extended itself beyond the joint towards the neck and breast. Several eminent surgeons being hereupon called into consultation, they all concluded that certain death was at hand, and that as the patient could not be preserved by amputation, he was to be left alone to his unhappy fate. But as the patient was in the flower of his age, and of an intrepid mind; and as there was no fever, although the arm smelt like a stinking carcase, which continually increasing was at last intolerable to the patient himself; notwithstanding these discouragements, as there was no sign of instant death, Le Motte was bold enough to oppose the opinion of the other surgeons, and persuaded the patient to an amputation,

which

^f De la Motte Traité complet de Chirurgie, Tom. III. obs. 311. p. 408.

which he observed could only put a more easy period to his life if it should prove unsuccessful. The arm was therefore amputated in the articulation of the shoulder, without any hæmorrhage, only a little reddish-coloured matter being discharged from the divided flesh: and in short, by the application of proper remedies, a separation was made of the remaining corrupted from the yet living parts, so that in fourteen days time there was no longer any of the corrupted parts remaining; and in a fortnight more, the patient was returned well to his friends, snatched in a manner out of the jaws of death.

3. This rule is a restriction to that given at n^o 1 of this aphorism: for although the sound part is to be preserved as much as possible, yet if it be foreseen that the remaining part of the stump will be more commodious for use by taking off more of the living parts than is absolutely necessary in order to separate those which are corrupted, in that case we need not scruple to remove more than is necessary. For since, as we shall presently observe, the amputation ought always to be made in the living parts, it matters not much whether it be made a little higher than the sphacelus.

§. 468. **T**HEREFORE in all limbs, except the legs, the amputation ought to be made in the sound parts which are nearest to the diseased, for the reasons given at n^o 1 and 2 of the preceding aphorism; but, in the legs, the amputation ought always to be made a little below the knee, for the reason given at n^o 3 of the same aphorism.

Various have been the opinions of authors concerning this matter; some thinking it more adviseable to amputate in the dead parts, for fear of the pain and hæmorrhage; while others, on the contrary, with good reason, prefer amputating in the parts which are sound and living. But although Celsus seems to have been the first who has written upon this observation, yet there are some passages to be found in Hippocrates ^a which seem to prove that he preferred amputating in the

^a De Articulis. Charter. Tom. XII. p. 446, 447.

the dead parts. For after he has said *that a complete amputation of the parts below the joints of the fingers generally is not followed with any bad consequence, except that the patient faints away in the operation^b*; he then adds, *And an entire amputation of the bones about the joints of the foot and hand, as also sometimes in the leg at the ancles, and sometimes in the arm at the wrist, may be generally performed without damage, unless the patient immediately faints away, or is afterwards invaded with a continual fever on the fourth day^c*. But in order to prevent the patient's fainting away when the limb is amputated, he a little afterwards advises, that the dead parts only, which are no longer sensible of pain, are to be cut off near the articulation, taking care to prevent future injuries. For (says he) *if the parts are sensible of pain in the amputation, their substance being not yet mortified, there is great danger of the patient's fainting away by the pain; and such faintings have suddenly carried off a great many people^d*. It therefore seems evident, that Hippocrates would have the amputation made only in the dead parts, leaving the separation of what is corrupted and still adheres to the sound parts to be performed by nature only; and that in such cases he would have the amputation to be made in the joints: for immediately after the preceding sentences he adds, *But when the thigh-bone has been laid bare in this manner, I have observed it to be cast off on the eightieth day; but the leg of that person was cut off at the knee on the twentieth day,^e &c.*

But Celsus describes the amputation to be made in the sound parts in the following manner: *The flesh is to be therefore divided by the scalpel betwixt the sound*
and

^b Quæcumque circa digitorum articulos integre abscinduntur, plerumque nullam inferre noxam, nisi homo, dum secantur, animi defectione lædatur.

^c Integræ autem abscissiones ossium, et circa articulos in pede et in manu, et in crure nonnullis circa malleolos, et in brachio nonnullis circa carpos, plerumque citra noxam fiunt, nisi protinus animi deliquium prosterнат, aut quarta die febris continua superveniat.

^d Si enim doluerit, qui secatur, et nondum, qua secatur, emortuum corpus fuerit, maximum periculum est, ne a dolore anima deficiat: ejusmodi autem animæ defectiones plurimos repente suffulerunt.

^e At femoris os hoc modo nudatum, vidi octogesimo die abscedere: crus tamen huic homini vigesimo die ad genu excisum est, &c.

and the diseased part, in such a manner as not to cut into the joint itself, and rather to take off some of the sound parts than to leave any of the corrupted behind ^f. This method of amputating is not given us by Galen, and is indeed but very obscurely mentioned by Ægineta; yet the latter seems to describe it as if made in the sound parts, because he is so fearful of a profuse hæmorrhage, and fastens a linen bandage round the parts to be divided, that they might not be put into pain by the saw drawn through them ^g. After these, the Arabians, and many other physicians and surgeons since, have ordered the amputation to be made in the dead parts, and then to destroy the corrupted flesh still adhering to the living, by applying the actual cautery. But that method has many inconveniencies which do not attend the amputation made in the living parts. For first the remaining dead parts are to be destroyed by the cautery, until the patient perceives pain in the living parts; by which means a crust is formed, which, adhering to the living parts, prevents the exhalation of the putrid vapours outwards; and then it will be necessary for that whole crust or eschar formed by the cautery to be separated from the living parts, which cannot be done without continual and great pain, as we shall declare hereafter in treating upon Burns. Besides this, by amputating thus in the mortified part, the bone divided by the saw will stick out a considerable way beyond the flesh which is destroyed by the cautery; and therefore all that protuberates in this manner must be of necessity again taken off by the saw, or else the cure will be rendered very tedious and prolix by waiting for a spontaneous separation of the carious end of the bone. But the reason which seems to have induced physicians and surgeons to make their amputation in the dead parts, seems to be to avoid the pain and hæmorrhage: whence, Celsus observes, it is that the amputation becomes very dangerous; *for very often the patient dies in the operation itself, either in a swoon*

or

^f *scilicet inter sanam vitiatamque partem incidenda scalpello caro usque ad articulum, ut neque contra ipsum articulum id fiat, et potius ex sana parte aliquid excidatur, quam ex ægra relinquantur.* Lib. vii. cap. 33. p. 498.

^g Lib. vi. cap. 84. p. 95.

or by loss of blood^h. But since this so much dreaded hæmorrhage can be easily restrained by the application of the modern tourniquet, with which the trunks even of the largest arteries may be compressed, and as also there is a stupor and insensibility produced in the part by the same pressure upon the nerves; it is sufficiently evident, that, with these advantages, it is much better to make the amputation in the living than in the dead parts, that thus all that is corrupted may be removed at one and the same time, and all the living parts be likewise preserved as much as possible. The several opinions of authors concerning the amputation of limbs have been collected and disposed in chronological order by the celebrated Petiteⁱ, who has thus demonstrated in what manner this branch of surgery has been by degrees advanced to its present perfection.

But since a regard is to be had to the future convenience and motion of the part, in determining the place for amputation; therefore that place is always fixed, in the leg, to be at the distance of about four or five fingers breadth from the joint: by which means the operation will not injure the tendons of those vast muscles arising from the thigh and inserted into the patella, nor will that ligament be divided which connects the tibia to the patella. And this place is to be chosen for amputating the leg, even though the sphacelus has reached no higher than the ankles: For if the amputation was to be made in a lower part, the patient would not be capable of standing afterwards on a wooden leg, without carrying the useless trunk of the limb bent backwards; and as the limb must be retained in that inflected posture during the patient's life, the articulation would become stiff, and render it troublesome for the patient to lie in bed, as well as render him incapable of many other offices of life. But when the limb has been amputated a little below the knee, several artificial machines may be then commodiously applied after cure, by which the loss of the limb may be in a great

^h Nam sæpe in ipso opere, vel profusione sanguinis, vel animæ defectione, moriuntur. *Lib. vii. cap. 33. p. 497.*

ⁱ Academie des Sciences, l'an 1732. *Mem. 286. &c.*

great measure compensated. Even sometimes this useless long part of the stump has so perplexed heroic warriors, that they had much rather have the amputation made below the knee, than be troubled with the incumbrance of such an useless part. Thus Pary^k relates, that when a certain captain lost his whole foot above the ankle by a cannon-ball, he found so much inconvenience from the stump after the wound was healed, that he suffered an amputation to be made below the knee. But although that part under the knee is to be chosen which lies beneath the strong tendon and ligament of the patella, yet the most skilful surgeons had rather amputate under the knee than in the thigh, even tho' it should be necessary to divide the ligament, because the use of the remaining part of the limb may be much more commodious that way. This operation last mentioned by dividing the ligament was happily performed in a woman who had broken the whole leg into small fragments quite up to the knee, which made it necessary to amputate the leg at the distance of about two inches from the joint^l.

§. 469. **I**N order to perform the amputation, and to understand what is necessary for the happy success thereof, a regard must be had, .

1. To the apparatus or preparation.
2. To the performance of the operation itself.
3. To the cure or treatment of the symptoms.
4. To the consolidation or cure of the wound.
5. To the supplying the lost limb.

In this aphorism are enumerated the several particulars which ought to be generally observed in every amputation of the larger limbs; and each of these we shall hereafter consider separately. But it is more especially of consequence to the happy performance of such a dangerous operation, to have first attentively considered every thing which ought to be prepared or

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^k Livre XII. chapit. 29. p. 305.

^l De la Motte Traite complet de Chirurgie, Tom. III. p. 427, &c.

3. The chief symptoms are, hæmorrhage and fainting; and therefore all those remedies ought to be had in readiness which we enumerated at §. 471, in order to stop the blood by applying them without any delay. It will be also proper to have in readiness some pleasant cordial, by which the patient may be instantly revived if he should happen to faint. But in the mean time it would seem cruel to revive the patient with cordials during the operation itself, or at least during the severest part of it, which may then be performed without the sense of pain. And since by the modern tourniquets the hæmorrhage may be securely stopped, therefore the fainting, proceeding from the fear or pain rather than the loss of blood, can be of no great consequence.

4, 5. These two considerations which respect the happy success of the operation, and the supplying of those defects incurred by the loss of the part, do not require their particulars to be had in readiness at the time of amputation; but these may be afterwards considered more leisurely.

THE preparation is made,

1. By compressing the large sanguiferous arteries by the application of pyramidal compresses or bolsters, and by twisting the ligature of the tourniquet over these compresses in the sound part near the diseased.
2. By strongly and equally drawing up the soft parts to be incised by means of a leather strap or bandage with loops and hooks.
3. By retaining the part to be amputated, with the patient's whole body, secure from moving.
4. By moderately inflecting the joint, that the soft parts may not be too much extended or cut off higher than they ought to be.
5. By giving the patient a cordial or sleeping draught before the operation.

1. There is no mention made of this among the ancient

cient physicians and surgeons; and therefore it is no wonder that ^b Celsus should say, that the amputation of limbs is extremely dangerous; for he describes the amputation to be made in the living parts, as is evident from what he there mentions. Therefore, when they divided the soft parts, the blood would consequently flow in a full stream from the divided arteries, so as not only to endanger the death of the patient, but also very much to disturb the operation itself; for all the parts being obscured with blood, must have hindered the surgeon from seeing what he was about. But what seems wonderful, we do not meet with the description of any distinct method for stopping the blood in amputations, before Parey ^c. They indeed attempted to stop the hæmorrhage by the actual cautery; but we here speak of that hæmorrhage which arises upon dividing the soft parts, before the bone is cut through by the saw. Even the method which Parey ^d used to restrain this hæmorrhage seems to have been very imperfect; since he orders a strong ligature to be made a little above the part where the amputation is to be made, and uses for this purpose a broad fillet with which women commonly tie up their hair. But it is evident enough that such a broad ligature cannot easily compress the larger arterial trunks, which are generally seated very deep; and yet we find that Hil-danus, Aquapendens, and others, made use of the same method. Morellus, who was an ingenious French surgeon, employed in the camp in the seventy-fourth year of his age, first invented the most happy method of stopping the hæmorrhage at the time of amputation ^e; namely, by the application of compresses or bolsters to those parts which were known by anatomy to contain the large arterial trunks; and then the ligature placed round the compresses was contracted by putting a small stick underneath and twisting it round, by which means the arteries which brought the blood to the amputating part might be contracted, or en-tirely

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^b Lib. viii. cap. 33. p. 497.
Mem. p. 288.

^c Academie des Sciences, l'an 1732,
des Sciences, l'an 1732, Mem. p. 289.

^d Livre xii. chap. 30. p. 306.

^e Academie

tirely compressed, at pleasure; and thus the hæmorrhage might be very safely prevented. But since this tourniquet, though extremely simple, was not without its inconveniencies, it was afterwards found necessary to correct or improve it: for when the stick was turned round to contract the ligature, the pinching up of the skin must have given the patient great pain; and then the pressure of this ligature not only acted upon the vessels to be compressed, but also powerfully constricted the whole circumference of the limb. It was also here necessary for a servant to employ his whole business in contracting or relaxing the ligature of this tourniquet, without assisting in any other part of the operation; and at the same time it was necessary for another assistant to hold the limb tight on the opposite side, whence a very great impediment must arise to the operator. When this tourniquet was a little relaxed after amputating the part, in order to point out to the surgeon the open mouths of the divided arteries by their evacuating the blood, the compresses were often by such relaxation removed, and sometimes the whole apparatus displaced, by which means a profuse hæmorrhage was occasioned, so as greatly to weaken the patient before the apparatus could be again properly disposed. In order to avoid these inconveniencies, the incomparable surgeon Petite contrived a tourniquet, which was more certainly capable of compressing the arteries and preventing the hæmorrhage, at the same time that it was free from all the before-mentioned inconveniencies. But a much better idea may be had of this instrument from the figure of it in *Mem. Royal Acad. des Sciences*^f; than can be conveyed by words. But instead of the pyramidal compresses, it is now usual to apply a cylinder of linen rags, rolled up so hard that it cannot easily change its figure but by a considerable force, and yet soft enough to yield to the required pressure: for if the cylinder was too soft, it would be pressed flat by the tourniquet, and by that means its pressure would be transferred not only to the artery, but also to the circumjacent parts, upon which it would act more than

upon

upon the artery, which is generally more deeply situated; and if it was too hard, it would only act upon the artery in a few points, which would therefore be apt to slip from under it. Lastly, it is required for that cylinder to be properly adapted and retained by a ligature, that it may not be displaced while the tourniquet is relaxed and again tightened to demonstrate the divided arteries. But it is evident enough that this cylinder ought to be of different magnitudes, according as it is to be applied to this or that part of the body, and also according to the age and stature of the patient who is to sustain the operation. But the parts where the arterial trunks are seated may be well enough known from the very authentic tables of Eustachius: as for example, if the amputation is to be made below the knee, the cylinder or compress is to be then applied in the ham; but if the amputation is to be made above the knee, the large trunk of the crural artery may be then compressed by applying the cylinder to the internal side of the thigh, &c. But since there are large trunks of nerves in most parts contiguous to the arteries, they will be also by this means compressed at the same time, whence will follow a stupor and insensibility in the parts below; and therefore the severe pain which usually accompanies this cruel operation, will be by that means in a great measure obtunded.

2. It was demonstrated in the commentaries on §. 158, n^o 1. that the soft parts of the body, which have been divided by any wounding cause, do gradually recede more and more from each other; and therefore all the soft parts will be contracted or shortened after the amputation of the limb. But the bone will continue of the same length, so as to project out a considerable distance beyond the equable surface of the wound itself, &c. But all that part of the bone which sticks out beyond the soft parts will be corrupted; and must be therefore again separated, either spontaneously or by the saw, from the other sound part of the bone covered with flesh; though such a spontaneous separation cannot take place but after a long space of time. The greatest care must be therefore taken not to let
the

the bone project beyond the soft part. This has been formerly an admonition of Celsus; who in treating on amputations of the limbs, says, *When you are come to the bone, the sound flesh is to be drawn up from it, and freed or cut from round the bone, that by this means some part of the bone may be laid bare; and after this the bone is to be sawed off as near as possible to the sound flesh adhering to it; and then the surface of the bone, which has been made rough by the teeth of the saw, is to be smoothed, and the skin drawn over it, which ought during the time of the operation to be drawn up as loose about the part as possible, in order that it may be capable of covering the bone afterwards on all sides,*^g &c. But Celsus takes no notice of the method by which the skin is to be preserved so loose that it may be afterwards able to cover the bone; for his intention seems to have been for the skin to be applied and conjoined to the yet bleeding parts, since he makes no mention of applying either ligatures or caustics to the vessels, but only says, *That the parts which are not covered by the skin are to be dressed with lint, over which a sponge dept in vinegar is to be secured by deligation. Afterwards the remainder of the cure is to be performed agreeable to the treatment of wounds which do not require any suppuration or cleansing*^h. It is therefore difficult to understand by what means he could suppress the hæmorrhage or complete the cure in this manner.

About the end of the last century, Verduinⁱ, a celebrated surgeon of Amsterdam, wrote a treatise concerning a new method of amputating limbs, an instance of which he gives us in the leg. He first divides the calf of the leg by a two-edged falciform knife down to the bone below that part where the amputation is to be

^g Ubi ad os ventum est, reducenda ab eo sana caro, et circa os subsecunda est; ut ea quoque parte aliquid ossis nudetur: dein id serrula præcidendum est, quam proxime sanæ carni etiam in hærenti: ac tum frons ossis, quam serrula exasperavit, lavanda est, supraque inducenda cutis, quæ sub ejusmodi curatione laxa esse debet, ut quam maxime os undique contegat, &c. *Lib. vii. cap. 33. p. 498.*

^h Quo cutis inducta non fuerit, id linamentis erit contegendum, et super id spongia ex aceto deliganda. Cætera postea sic facienda, ut in vulneribus, in quibus pus non moveri debet, præceptum est. *Ibidem.*

ⁱ Dissert. Epistolæ de nova artuum decurtatione. Amstelædami, 1696.

be made, and from thence he frees the calf from its adhesion to the bones upward to the place where the amputation is to be made; making a transverse division of the other parts of the skin and flesh, and separating the periosteum from the bones, he then divides them by the saw. But in the mean time, while the bones are dividing by the saw, the fleshy portion of the calf and skin of the leg are drawn back, that they may not be injured by the teeth of the saw. After the bones are divided, the wound is washed with warm water, for fear any saw-dust should remain in the wound which might retard the cure; and then the remaining portion of flesh and skin is instantly bent forward, and adapted to the stump of the amputated limb, and the lips of the wound dressed with lint, puff-ball, or any convenient styptic powder, and the whole stump is then covered with an ox's-bladder moistened in cold water, and all the dressings are retained by a suitable bandage. This method is illustrated in the same treatise with neat figures, which are also to be found in the *Bibliotheca Anatomico-chirurgica of Mangetus*, Tom. I. But the author denominates this method of amputation, 'The cure of extirpated limbs by incision; and the whole design of it consists in applying the remaining part of the flesh and skin to the surface of the crude wound, so as to close the mouths of the divided arteries, and cause the contiguous fresh lips of the wound to grow together so as instantly to cover the nakedness of the bones.

Nor does this author so much fear an exfoliation of the bone which was divided by the saw, and brought into contact with air, since he had found that this was not so necessary as many believed. He also adds, that the flesh which covers the stump always spreads to some distance beyond the margin of the wound; which yet is no inconvenience, since at length those lips are contracted so as to form but a small cicatrix. But those soft parts which have been thus adapted and conjoined to the stump, serve as a cushion upon which the ends of the bones may sustain the whole weight of the body without causing any pain. The same author observes that this method succeeded with him in a young man; and

and relates that it was afterwards put in practice by the surgeons in the hospital of Amsterdam, where a man of thirty years of age had his leg in this manner happily amputated.

About the same time there was a certain surgeon of Geneva named Sabourin, to whom the same notion occurred, which he does not seem to have derived from the forementioned author, because he applies this method to amputation in the joints, and uses a quite different manner of deligation. In the second year of the present century, this method was proposed to the Royal Academy of Sciences at Paris; and the author relates that he once performed it with so much success, that the patient did not lose above four or five ounces of blood during the whole time of the operation. The same surgeon put this new method in practice at the hospital of Paris, by order of the academy, in the presence of the two best judges in these matters, Du Verney and Mery. However, the patient died; yet could not his death be with reason ascribed to any fault in the operation, altho' the loss of blood was larger than is usual in the common method of amputating^k.

The celebrated Heister^l, in his surgery, denies the honour of this invention to the two forementioned authors; and ascribes the same to James Young, who he asserts to have described this method in his *Currus triumphalis terebinthinæ*, or *Triumphal chariot of turpentine*, &c. published at London in the year 1679. Ruysch^m has also given us a description of this method of operating, which was performed in his own presence, and with happy success, from whence he concludes that this new method ought to be received. But after a while this method was again despised; and, as the celebrated Heisterⁿ testifies, was deserted even by Verduin himself, and the other surgeons of Amsterdam, who returned to the old method. But Garengeot^o, who has also largely described this method, and illustrated the same with figures, wishes that it might be

^k Academ. des Sciences, l'an 1702, Hist. p. 43.

^l P. 505.

^m Epist. Problem. decima quarta, p. 9. &c.

ⁿ Institut. Chirurg.

p. 506.

^o Operations de Chirurgie, Tom. III. p. 413.

be again tried in the hospitals; and adds, that the same method had been known to succeed happily in many instances.

Thus various seems to have been the fate of this method, inasmuch that at present it is not at all used in these countries. But although, in the common method of amputating, it is not possible to cover the whole surface of the stump with flesh and skin, yet by proper care we may prevent the end of the bone from sticking out afterwards beyond the surface of the soft parts. In the first place, let a strap of soft leather be fastened firmly round the limb, immediately above the part where the amputation is to be made; which strap or belt of leather being furnished with handles or loops, are to receive two slings passing through them, which by an assistant are to be drawn upwards, and thus all the soft parts will be drawn back as much as possible before the incision is made; and when the amputation is performed, upon taking off the leather strap, the parts drawn up will subside or descend so as to cover the bone, which will not then project beyond the surface of the soft parts. For these purposes Hildanus^p has described and figured a kind of sleeve or bag of a conical shape.

3. Before this operation is attempted, we ought to be first certain, that not only the part itself to be amputated, but also the patient's body, is held firm and immovable, so as not to disturb the surgeon in his operation: for notwithstanding many believe, having never experienced these pains, that they shall have resolution enough to sustain the operation without being held by ligatures or the hands of assistants; yet prudence commands the surgeon never to trust to these promises. At the same time care must be also taken that the assistants are such as have sufficient courage to enable them to perform their part with readiness, unconcerned and unaffected by the spectacle: which firmness is a qualification much required by Celsus in a surgeon; whom he would have to be a person of an intrepid mind; mercilefs; and incapable of being moved
by

by the cries or the misery of the patient, so as to make more haste than the case requires, or to cut less than is necessary. There are many assistants who boast of their courage in these operations, who, being afterwards confounded, can neither understand nor perform what is ordered by the operator; and even sometimes they faint away, so as to disconcert the surgeon in his operation, and cause the patient to be longer retained in his misery.

4. This is a rule of the greatest consequence. For the part ought to be so disposed after the operation, that it may continue in the same posture the longest time with the least uneasiness: that is, to dispose the parts in their natural situation, which we observe in a healthy person during the time of sleep, when all the voluntary motions are silent; for all the joints of the body at that time appear a little inflected, nor is any one of the members then extended. This has been very well observed by Hippocrates, where he describes the most convenient posture for a diseased patient to lie in, as we mentioned before in the commentaries on §. 211. where we also gave the reasons why the limbs are gently inflected when all the voluntary motions of the muscles are quiet. But if a part is kept violently extended during the time of the amputation, after the operation is over it is usual to suppress the hæmorrhage by tying up the vessels, as we shall explain at §. 471, n^o 1.; and in performing this, there is very often some of the adjacent soft flesh intercepted by the ligature, so that, by altering the posture of the amputated limb after the vessels are tied up, the muscular flesh intercepted by the ligature will be drawn up, whence the most acute pains and the worst symptoms often follow, all which might have been avoided by keeping the part moderately inflected during the time of the amputation.

5. With what a needless fear physicians formerly avoided these excellent medicines, was said before in the commentaries on §. 202, 229. But a prudent use of them eases the most acute pains almost like a charm, and removes the grief of the mind: and this more especially

pecially, when opium is given in such a quantity as only to induce a pleasing indolence and sleepiness rather than a deep sleep; for then the mind is put into such a serene and quiet posture, even in the most watchful person, as no one can imagine but from experience. I well remember myself to have taken a single grain of opium, to ease a troublesome pain: which had such an effect, that I lay watchful all the night, but without pain; and with so much pleasure of mind, that the poets could not have feigned a more happy state in their elysian fields. The next morning, after a short sickness, I easily vomited, and at the same time brought up the little pill of opium not yet entirely dissolved, whereupon the happy indolence went off. Narcotic remedies may be therefore of the greatest use, exhibited an hour or two before the operation: but this not with a view, that, by laying the patient to sleep, he might be insensible of his pain, (for to give opium in such a quantity would be extremely dangerous); but only to remove, or at least to diminish, the fear of the present operation. For although this operation is very severe, and not practicable without extreme pain, yet that fear of it is more troublesome which continually represents the image of the approaching evil to the mind, for then the unfortunate patient counts every minute of the hour before the time appointed for the amputation. Hence Julius Cæsar^r with great reason confessed that it seemed more desirable to suffer at once a whole multitude of impending dangers than to be always in fear of them. We are taught indeed, by uncommon instances, that this precaution is not always necessary, and that there are some people who know how to support their future misfortunes with intrepidity of mind. Thus a great-spirited hero, who was troubled for the space of twenty years with a fistulous ulcer in his leg from a musket-shot, at last concluded that it was necessary to have it amputated, and did himself appoint the day and hour when he would have it performed: and when the physicians and surgeons came at the appointed time, they found him

sleeping^f. Another instance of this nature we have in the captain of a man of war, who, after it was determined to amputate his arm in the articulation near the shoulder, asked the surgeons whether he might not first recover himself by sleep, being much fatigued by continual watching for several days; which being allowed him, he slept very quietly^t. But few there are who enjoy this unshaken strength of mind; and therefore others are to be assisted in this respect by art, since it may be very safely done. The Turks take opium, that they may with intrepidity despise the dangers of war; whence Bellonious^u relates, that the whole province is almost exhausted of opium when the emperor of the Turks, being about to wage war, assembles his soldiers. The form of such a narcotic and cordial medicine may be seen in the *Materia Medica* corresponding to this number of the present aphorism.

§. 470. **T**HE amputation is performed in the part, thus prepared (469),

1. By a strong, sharp, and well-tempered crooked knife, obtuse on the back, carried strongly and equally in a circle round and through all the soft parts to the bone, so that the whole periosteum may be exactly divided by one swift incision.

2. If there are two bones in the part to be amputated, the intervening flesh betwixt the bones is to be in like manner very exactly divided by a sharp catlin or two-edged knife passed betwixt them.

3 The parts thus divided (n^o 1, 2.) are to be next strongly drawn up by assistants in order to make an opening for the saw betwixt the divided slips of the soft parts.

4. Then the bone is to be cut through by a sharp, thin, strong, and tight saw, guided perpendicularly with a strong and equable motion; beginning

^f Academ. des Sciences, l'an 1731, Mem. p. 142, &c.

^t De la Motte Traite complet de Chirurgie, Tom. III. p. 423.

^u Observat. lib. iii. cap. 15. p. 179.

ginning first to divide the smallest of the bones when there are two, and terminating upon the largest of them, that the weaker bone may not be broken into splinters by the force of the saw.

5. During the time of sawing, the bones are to be cautiously inflected a little by the assistants, to make a free passage for the saw.

1. The first thing to be done in the amputation itself, is to make a very speedy incision through all the soft parts to the bones at one and the same time, so as by that means a free passage may be given to the saw. But, to perform this incision, a very sharp knife is required; but yet so shaped as not to have its edge too thin, since that would render it liable to be blunted by pressing against the bone. But since the extreme parts of the body are generally of a roundish figure, therefore the amputating knife ought to be incurvated, to cut through a larger surface of the parts at once. This incurvation of the knife ought to be but moderate; and continued equally throughout the whole extent of its blade, and not at the point only. Garengéot^a, who has given us an exact description of every thing that is to be observed with regard to the make of this knife, tells us, that the most convenient figure of it is that of a portion of such a large circle, that the radius let fall perpendicularly from this arch into the subtense chord may scarcely exceed an inch. But in the mean time it is sufficiently evident, that the thigh requires a larger knife for its amputation than the arm; and that therefore the surgeon's armory should be furnished with more knives than one, of different magnitudes, for this operation. But the back of the knife should be so obtuse as to be capable of bearing the pressure of the surgeon's hand or fingers without injuring them, in order to direct the knife properly in its course. This knife is to be guided through the skin and flesh down to the bone; and while its edge remains close to the bone, it is to be carried round in a circle, till all the

P 2. parts;

^a Instrumens de Chirurgie, Tom. II. p. 160.

parts are divided, and especially the periosteum of the bone itself. Heister ^b would first have the skin and fat divided by a circular incision, and afterwards drawn back as much as possible, that so the muscles and bone may be divided higher up, and that, after the operation is finished, there may be more of the skin and fat to cover the stump. But in this manner there are two incisions to be made instead of one, which might be otherwise carried speedily at once round the whole limb. But as it is often necessary to apply sticking plaisters after the amputation, for various uses; therefore it will be proper to shave off the hair from the skin of the circumjacent flesh before the amputation is made, to avoid giving the patient unnecessary pain afterwards at the removing of the sticking plaisters ^c.

2. If there is but one bone in the part to be amputated, the preceding method will be sufficient; but where there are two bones, as in the cubitus and leg, in that case those parts which are intercepted betwixt the two bones cannot be divided by this first incision, and therefore it will be necessary to make a second. But as in some parts the distance of the bones from each other is no more than equal to three or four lines only, as for instance, betwixt the tibia and fibula; therefore the before-mentioned author, in his treatise of instruments, very justly observes, that the catlin or small knife used for this purpose of cutting betwixt the bones ought to have a narrow blade ^d. To which add, that in those places where there are two bones, the whole periosteum of each bone cannot be entirely divided at one incision; for that part of this membrane, which covers the bones on their innermost sides, where they lie next to each other, cannot be reached by the crooked knife, as any one may readily perceive. This small knife therefore or catlin must be used to make a perfect division of those parts, together with the periosteum, which lie betwixt the two bones, that they may not be afterward lacerated by the rough teeth of the saw, to the great pain of the patient. Care must be also taken

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^b Institut. Chirurg. p. 497, 508.
^c Chirurgie, Tom. III. p. 356, 386.

^c Garengéot Operations,
^d Tom. II. p. 169.

to examine whether any of the flesh or periosteum is not yet divided entirely in any other part. From all which it is evident, what improvement has been made in the art of making amputations; since, by compressing the arteries, there is no danger of hæmorrhage during the whole time of the operation; without which compressure the effusion of the blood would render it impossible to distinguish whether all the soft parts were divided close to the bone.

3. But that the saw may pass freely through the bone, the divided soft parts are to be drawn from each other in contrary directions, but more especially upwards, that more of the flesh may be drawn up from the bone, which may be then taken off higher; and thus there will be less danger afterwards lest the end of the amputated bone should project out beyond the equal surface of the wound. Now this may be done by drawing up the soft parts by the leather ring or girdle which is applied above the incision, as we observed before at n^o 2. under the preceding aphorism. The parts may be also conveniently drawn up by the following method. Take a piece of linen, of a foot or more in length, and five or six inches in breadth; but one end of this piece of linen is to be slit up for about two thirds of its length. The two extremities of the slit end are to be passed betwixt the divided flesh, so as to intercept the naked bone betwixt them; and when the two ends are crossed over each other on the opposite side, both extremities of the piece of linen are drawn up at the same time; whence it is evident that the soft parts will be drawn equally upwards, so as to expose a larger surface of the bone to view, and at the same time prevent the soft parts themselves from being injured by the teeth of the saw. But in the mean time care must be taken not to let the teeth of the saw be caught in the piece of linen itself, which would disturb the operation.

4. What is necessary to be observed with regard to the construction of an amputating saw, may be seen in the treatise of instruments published by Garen-

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geot.

geot f. It may be sufficient for us to remark its chief and most necessary qualifications. It ought to be thin and sharp, that it may cut through the bones with a small force; for if it was made of a thick iron plate, so much more of the bone would be taken off by the teeth as would render its descent through the bone very difficult, and would therefore require to be pressed by a greater force. But then the greater thinness of the saw renders it more apt to be broken when the steel is very rigid and elastic; or at least it will be apt to bend, if it is less rigid and not so apt to break. But this last inconveniency of bending may be prevented, since the blade of the saw may be tightened at pleasure, by drawing more of it out through the arched steel handle; by means of a screw; and the former may be avoided, if the steel plate of which the saw is made be well tempered and not too rigid. Nor can the saw be easily broken if it is moved perpendicularly, and in a strait line through the bone; but when it is bent in the bone, it sticks, nor is it possible to move the blade of the saw either one way or other but by a considerable force, whence there will be frequently danger of breaking it. Such a misfortune happened to a certain surgeon, as we are told by Hildanus g; and as at that time it was not yet customary to stop the hæmorrhage by the tourniquet, the patient was almost lost before another saw could be had to finish the operation: whence Hildanus advises always to have in readiness two saws of the same thickness, when any limb is to be amputated.

But the saw is to be applied to the bone as close to the surface of the soft parts as can be well allowed without injury; and then a slight notch or entrance is to be gently made by passing the teeth of the saw perpendicularly thro' the bone: when once this entrance is made, there will not then be so much danger that the teeth of the saw may deviate from their proper course, since they will be directed by the sides of the bone. The sawing of the bone is then continued with an equable motion, taking care as much as possible not

to

f *Instrumens de Chirurgie*, Tom. II. p. 173.

g *De Gangræna et Sphacelo*, cap. 18. p. 807.

to deviate from a right line: for otherwise the saw would stick immoveable, so as to render it necessary to make a fresh incision through another part of the bone by the same saw; or else the saw will be in danger of breaking, by working it in a crooked direction. It must be also observed, that no great force is required to press the saw against the bone, which in a dead body as well as in a living person is soft and juicy, so as to be easily capable of giving way to the instrument: whereas too great a pressure would force the teeth of the saw too deeply into the substance of the bone; whence it could not be equally carried backward and forward, but would move by starts. But when there are two bones in the part to be amputated, and there is a considerable difference in the strength and size of each, as for instance in the leg, (for in the radius and ulna of the arm there is not so much difference); then the best method is to enter the saw first into the tibia, inclining it afterwards to cut through the fibula, taking care in the mean time to let the fibula be divided before the tibia is quite cut through; for without this caution there would be danger of breaking the fibula into splinters, if it alone was obliged to sustain the whole weight and pressure of the saw. But it is evident enough, from the known situation of these bones, that the most commodious situation of the surgeon to perform this operation, will be to stand betwixt the patient's legs, and not on the outside of them, as is badly represented in the figures of Hildanus^h:

5. For when the saw has descended to a considerable depth through the substance of the bone, if that assistant who holds the thigh or leg to be amputated near the knee gently elevates the part, while the other assistant a little depresses the foot, the opening will be increased betwixt the divided parts of the bone, and a very free passage made for the motion of the saw. But if these assistants are ignorant of their office in this respect, or if they should be disturbed or frightened in their minds, it is evident they may be of great detriment to the operation.

§. 471. **T**HE chief of the symptoms following after the amputation is the hæmorrhage; which ought always to be immediately suppressed,

1. By passing a thread round, and close tying up, the larger vessels, after they have been discovered by their spouting out the blood, drawing out their ends by a pair of flat spring-pliers; or else by tying up the vessels with a thread passed through two crooked needles, which are to be inserted one on each side the vessel.
2. By the application of actual cauteries to the mouth of the vessels.
3. By pledgets which have been dipped in a solution of vitriol and dried, or armed with other astringent medicines before they are applied to the parts.
4. By the relaxing and returning or putting down the living soft parts which were drawn back, (469, n^o 2.)
5. By applying a bladder over the whole stump, filled with the astringent powder.
6. By the application of a retentive bandage upon the whole apparatus of dressings.
7. By procuring rest and sleep to the patient, and ordering a proper regimen of diet.

After the limb has been amputated, the divided vessels gape open, so that unless the tourniquet compresses the trunk of the artery which leads to that part, the blood will flow in a full stream. But the ligature of the tourniquet cannot possibly be left adhering to the part, because, by intercepting entirely the influx of the arterial blood into the part, a new gangrene or sphacelus would follow. Therefore the mouths of the divided vessels ought to be closed in such a manner, by whatever method, that there may be no danger of a hæmor-

hæmorrhage following after the tourniquet has been removed from compressing the arterial trunks. But some authors would not have the hæmorrhage immediately suppressed; for they say it is of some service for a quantity of blood to be discharged, partly to diminish the abundance of the whole mass, and partly to evacuate that part of the blood which stagnated in the vessels near the mortified part, and which perhaps has from thence contracted some degree of malignity. But since at present the custom is to amputate in the living part, there can be no danger of any such consequence; and if it should afterwards appear, that the blood, abounding in too great a quantity, or being too much rarefied, should require evacuation, or impede the cure; that may be easily remedied by opening a vein. It therefore seems to follow, that the hæmorrhage ought to be stopped immediately after the amputation of the limb; the method of performing which we shall consider in the following numbers.

1. In the commentary on §. 218, n^o 4. it was said, that Parey was the first who made a ligature upon the vessels after amputations of the limbs, and at the same time condemned the cruel method of applying actual cauteries to the stump. Since his time all surgeons have followed the same method.

But in order to make this ligature upon the vessels properly, the tourniquet is a little relaxed, that the blood flowing from the mouths of the divided vessels may point out where they are seated. They are then tied after a two-fold manner; either by taking hold of them with a pair of pliers, which spontaneously shuts close with a spring, (the figure of which is given by Garengot^a,) by which means the extremity of the vessel is held fast, and drawn out beyond the surface of the wound, so as to be afterwards easily tied. But it is very evident, that the blood driven against the ligature will gradually thrust it forward in such a manner, that there will be danger of the ligature falling off and renewing the hæmorrhage; whence others rather advise to pass a needle and thread through the substance of the

^a Instrumens de Chirurgie, Tom. II. p. 183, &c.

the artery, and then to make a strict ligature by passing the thread round it (see the commentary on §. 218. n^o 4.) The other, and at this day the most usual, method, is, To pass a very crooked needle, armed with several threads (not twisted together, but lying flat by the side of each other), thro' the flesh which lies round the artery; first making a ligature in this manner above the place of the artery, and then passing the needle as before with the same threads below the artery, in such a manner as to make four openings by these two punctures, which punctures include a square space, in the middle of which the artery is contained which is to be secured by ligature^b. The ends of the threads are then tied together in a knot; and thus the artery is closed by the ligature, which does not immediately touch the artery itself, but equally compresses the same by intercepting some of the circumjacent flesh at the same time. But frequently the most skilful surgeons have rather chosen to follow the former method of tying the vessels by the use of the pliers, than by passing needles through the adjacent flesh, because they feared intense pains, convulsions, and the worst symptoms, from the nerves or tendinous parts being punctured or intercepted by the ligature. Thus the incomparable surgeon Le Motte^c tells us, that he always uses the former method; or else applies little balls of vitriol to the mouths of the divided vessels for suppressing the hæmorrhage after the amputation of limbs. But he not only took hold of the artery, but also of the circumjacent flesh, by the pliers, when he tied them by ligature; and thus there was less danger lest the ligature should slip off before its time. But in the mean time he does not altogether condemn the other method; but even in the same place candidly relates the happy success thereof, when, after a dangerous amputation of the humerus near the articulation of the shoulder, the artery was closed by passing a thread through the flesh, so as to compress it against the bone, which succeeded without any bad symptom.

But

^b Garengot *Operations de Chirurgie*, Tom. III. p. 375.

^c *Traite complet de Chirurgie*, Tom. III. p. 425.

But it is observed, that both fear and pain occasions the patient sometimes to faint away, whence the blood does not start out impetuously, only through the larger vessels at the time of the operation; so that, unless all the considerable arterial branches are thus secured by ligature, there will be danger of a fresh hæmorrhage, and it will be afterwards necessary to remove the whole apparatus to suppress it. It is therefore much better to give the patient some cordial to recruit his strength, and to observe diligently whether any blood starts violently through some considerable artery as yet left open, and then to repeat the ligature as before. This being done, there will be no longer any danger of a hæmorrhage, nor will there be any occasion for actual cauteries; nor yet will it be necessary to make such strict ligatures as will be in danger of confusing or cutting thro' the recent flesh, so as to produce a new inflammation or even a gangrene.

2. The prevailing and universal method of suppressing hæmorrhages until the time of Parey seems to have been by the application of actual cauteries. Even Hildanus^d not only recommends the use of cauteries after the amputation of limbs, but he also bestows great encomiums upon the method of amputating with a red-hot knife; namely, that by dividing the soft parts down to the bone with a red-hot knife, the hæmorrhage might be suppressed at the same time that the amputation was made. But even after such an operation the burnt parts must be separated from the surface of the wound by suppuration; and therefore there would be danger of the bone projecting beyond the surface of the soft parts, so as to render the cure very tedious and difficult. But it is certain that these authors intend that the bone itself should be also burnt by the cautery; and even then a very long time would be required to procure a separation of the dead parts of the bone, notwithstanding the author before mentioned insists on the contrary. See what has been said concerning the use of actual cauteries in suppressing hæmorrhages under §. 218, 2^o 1, 4. where reasons are also given why the best surgeons

^d De Gangrana et Sphacelo, cap. 19. p. 812, 813.

geons abstain from that method.

3. Take vitriol, especially the Cyprian, reduced to a powder, which being sprinkled upon pledgets, is to be applied to the divided vessels; or what is rather better, let the pulverized vitriol be received into cotton formed into round nodules, or else formed into little cones to be applied to the ends of the divided vessels. So soon as the effluent blood touches the vitriol, it congeals into a thrombus or grume, which stops up the orifice of the divided vessel, and by that means suppresses the hæmorrhage. But when very large arteries are divided, the great impetus or velocity of the blood forces away these obstacles from the mouths of the vessels, which makes it necessary to retain those applications by an external pressure; and therefore servants are to attend day and night to retain the dressings by a gentle pressure upon the parts. Besides this, the vitriol, which touches the ends of the vessels and bleeding flesh, converts the parts in contact into an eschar, which must be afterwards separated; and when that eschar falls off, there will be danger of a fresh hæmorrhage, as we observed before in the commentary on §. 218. And hence it is that almost all the modern surgeons trust to ligature of the vessels; and never apply vitriol, unless the artery is inaccessible, and cannot be easily taken hold of by ligature. But, even in such cases, the vitriol is only applied to the orifices of the larger vessels; while the remaining parts of the stump, which are full of numerous smaller arteries, are only dressed with things which absorb blood, and which together with the blood form a crust, stopping up the mouths of the divided smaller arteries. But when care has been taken to prevent any hæmorrhage from the larger arterial trunks which have been divided, it is evident that there will be no occasion to fear any bad consequences from the division of the smaller arteries, even though they should continue still bleeding slowly; for these smaller branches naturally contract and close of themselves in a little time, as was proved in the commentary on §. 159.

4. In the preparation previous to the amputation
itself

itself, it was observed, that the skin and subjacent soft parts ought to be drawn upwards as much as possible, and to be retained in that posture till the amputation is performed; and that after this the soft parts are to be drawn downward, that the end of the divided bone may not project beyond the surface of the wound: and while this is performing, the distended vessels are relaxed; whence they spontaneously contract their divided extremities, and draw them within the subjacent soft parts. Thus the returning down of the soft parts, which were before drawn up, generally conduces very much towards suppressing the hæmorrhage. After this Parey^c directs to perforate the stump with a needle and thread in four different places, and, by drawing the threads together across each other, to approximate and retain the soft parts nearer together and in their proper situations. But if these cruciform threads are violently drawn together, a very severe pain and violent inflammation is excited, so as to make it necessary to divide them afterwards; and if they are only drawn loosely together before they are tied, they will be of no service.

5. As nothing is more to be feared after the amputation of a limb than an hæmorrhage, therefore surgeons have used all their endeavours to guard against and to remedy this accident. And although the tying up of the larger vessels, and the application of absorbent powders to the stump, seem sufficiently to guard against this dangerous symptom; yet it is usual also to apply a bladder filled with the like powder, so as to invest and wrap round the whole end of the amputated limb; that if any blood should still be discharged, or that if unfortunately any ligature should be loosened from some arterial trunk, those powders might suppress the hæmorrhage by concreting instantly with the blood into a solid mass. But in the commentary on §. 218, n^o 3. we affirmed, that these astringents are of little efficacy, unless they are also joined with a suitable compressure, by which alone the hæmorrhage may be effectually suppressed without the assistance of

these powders, as was proved at n^o 6. under the same aphorism. Among these powders the chief are, The volatile meals of ground corn, alabaster calcined, Armenian bole, though others recommend a mixture of colophony or rosin; to which add the fungus pulverulentus or puff-ball cut into thin slices, which are used for this purpose by our surgeons, and with very good success. In our professor's *Materia Medica* corresponding to this aphorism, you will meet with several forms of these remedies. But the celebrated physician and anatomist, Monro^f, who has given us several very useful observations concerning the amputation of limbs, takes notice, that the use of these astringent powders has been a long time rejected by the Scotch surgeons, because, mixing with the blood and other affluent juices, they concrete into hard lumps, which injure the tender surface of the wound; and because it is afterwards very difficult to remove or cleanse them from off the parts, to which they very firmly adhere. He therefore advises, that, after tying up the larger arteries, the rest of the surface of the stump should be covered with very soft and clean-scraped lint, which does not injure the tender wound, while at the same time it absorbs the affluent juices. And he also observes in the same place, that this intention will be answered much better, and a more equable compresure will be made, if the lint is laid on irregularly, not rolled up or formed into pledgets, but in loose portions differing in thickness, according as the greater or less inequality or hollowness of the surface of the part may require.

6. Since there is no danger of a hæmorrhage following, after the divided ends of the larger arteries have been secured by the prevailing method of ligature which now obtains, it is evident that the bandage will not be required to be very tight, only to be sufficient by a gentle pressure to retain the scraped lint and other dressings upon the affected part. For if the bandage makes too great a stricture upon the circumjacent parts, many bad consequences will follow: for the whole
pressure

pressure of the bandage will be returned upon the soft parts only, since the bone itself cannot give way; by which means the flesh will be thrust upward, and the bone itself left bare. Besides this, the recent wound (§. 158, n° 5.) will begin to swell, become hot, painful, and inflamed, whence there will be great danger of a gangrene from the violent compressure, (see §. 422, n° 6.) Hence it is, that the most prudent surgeons rather chuse to have the styptic powders and other dressings retained upon the parts by a gentle pressure, continued day and night by the hands of servants, whenever they are fearful of a fresh hæmorrhage.

7. How necessary it is to avert the watchings, and to procure rest to wounded patients, was demonstrated before in the commentary on §. 202. where we also affirmed the use of narcotics with discretion to be very safe in these cases; and much more will they be serviceable after amputations of the limbs. But when a narcotic has been given a short time before the operation (§. 469, n° 5.) it continues to act some hours after it is performed, and occasions a gentle sleep: which will be also much promoted by that tranquillity and calmness of mind, which usually follows when the patient has gone through the operation, which he but a little before so much dreaded. But how dangerous it is to move the stump about, when the patient is restless, may appear from that case which we mentioned upon another occasion in the commentary on §. 218, n° 6. namely, The thigh of a certain nobleman being amputated, who sustained the operation with great courage, the cure seemed to succeed happily until the twenty-first day after the operation; when, upon raising himself up forcibly and by himself in the bed, he had soon cause to repent his imprudence, by the instant return of a profuse hæmorrhage, even though the arteries were closed by ligature; insomuch that he could scarcely be saved from the danger by the assistance of that excellent tourniquet invented by the celebrated Perit^s, by which the mouth of the open artery was compressed, and at the same time the trunk above the

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wound

wound could be contracted or stopped at pleasure. But every thing which has been said concerning the regimen of diet in wounded patients (from §. 192, to 197.) ought to be here diligently observed; for even the least error in diet may be injurious in so great a wound, since the recent chyle often as yet retains the nature of the indigested aliments for a long time, and is frequently derived in great quantities towards this less resisting part, as we observed in the commentary on §. 192. Besides this, since a very large part of the body is often removed by amputation, the diet must be proportionably lessened, since the body requires less nourishment than before, and since all the superfluous juices will be urged to this least resisting part, whence will follow too great a dilatation of the vessels, fungous or proud flesh, &c.

§. 472. **T**HE healing of the bone is performed by procuring a speedy exfoliation, and preventing a caries; which may be done by the immediate application of a compress moistened in tincture of mastic made with spirit of wine.

The surface of the amputated bone being contused by the rough teeth of the saw, seems to render it necessary to make a separation of its external surface; to promote which, surgeons were in use to apply an actual cautery to the naked bone^a. But that is a method at this day justly in disuse. For it was demonstrated, in the history of wounds and fractures of the brain, that the consolidation of the bone, and the separation of its corrupted part, did not require any such violent remedy, but might be happily procured barely by defending it from the air, and from oily or fat substances. If therefore a pledget, dipped in spirit of wine and mastic, or the like, be immediately applied after the amputation of the bone, and the air thereby excluded, a very happy cure usually follows; as was said before in the commentary on §. 252, n^o 2. But when an ac-

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^a Ambrose Pare, Livre xii. chap. 36. p. 308.

tual cautery is applied to burn the bone, a separation must certainly follow of all that which is destroyed by the violence of the fire, whence the cure will be retarded. But even the most faithful observations demonstrate, that an exfoliation of the divided extremity of the bone is not always necessary. For, in the method which we mentioned in the commentary on §. 469, no 2. by which the amputated limb is covered with the flesh that had been loosened and drawn up from the bone, that flesh being immediately applied grows to the surface of the stump: and Ruyſch ^b himself testifies, that he never observed any sensible separation of the extremities of the bones of the cubitus and radius during the whole cure of an arm amputated in this manner, and which was under his own inspection as well when the amputation was performed as at every time of its being dressed afterwards; and he believes that this followed, because the flesh was immediately applied to cover the extremities of the bones, so as to preserve them from being injured by the air, to which they were less exposed than in the common method of amputating. But even in the common method of amputating, though the bones are exposed a longer time to the air, yet there is not always a separation of any visible parts from the bones, as is observed by the celebrated Monro ^c: for in fourteen cases of amputations, he observed only three in which there were particles of the bones separated, whereas in the rest there was not so much as the least appearance of an exfoliation; from whence it is evident, that it is by no means requisite to promote the exfoliation of the amputated bone, since it is not always necessary.

§. 473. **B**UT the cure of the fleshy parts of the hump is to be performed agreeable to what has been delivered before in the history of wounds, (from §. 189, and 192 to 210.)

Every thing that has been said concerning the cure of wounds, under the aphorisms above cited, ought

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also

also to be observed in this place. But the celebrated Monro^a remarks, that care should be taken not to remove the first apparatus of dressings too soon. For the scraped lint, styptic powders, &c. usually adhere very firmly to the surface of the wound, from whence they cannot be removed without danger of a fresh hæmorrhage, unless they are left upon the part until a supuration follows, by which they become moist and fall off almost spontaneously: for these reasons, therefore, he would not have the dressings removed before the fifth day, if nothing happens amiss. But if a fetid smell is perceived by the blood or ichor penetrating the bandages, he orders them to be cut off with a pair of scissors, and all those parts to be removed which do not adhere firmly to the wound; after which he would have clean lint applied, and the part to be bound up as before. But even after the removal of the first dressings, he recommends them to be seldom repeated, only every second or third day, when the itching perceived in the wounded parts denotes that the matter begins to turn acrimonious. He likewise advises to prevent the growth of fungous or proud flesh, by a gentle compressure made with scraped lint; and if the threads with which the arteries are tied, do not fall off soon enough, but begin to be covered by the growing flesh, he orders them to be cautiously cut off, lest, if they should remain longer, they could not be conveniently extracted, but a fistulous ulcer might from thence remain a long time after.

But although the amputation of a limb be performed by the most dextrous surgeon, and all the cautions before enumerated have been strictly observed, yet there are some bad consequences which often cannot be easily prevented, nor even removed by any art. It was said before, in the commentaries on §. 172, n^o 1. that the cure sometimes became very difficult from the large quantity of matter daily collected upon the surface of so broad a wound as must necessarily be made in the amputation of any of the larger limbs: for by the frequent absterfion of the matter, the wound often dege-

degenerates into the nature of an issue, discharging an incredible quantity of matter daily; in which discharge the nourishment of the body being exhausted, the whole body is in a little time consumed with a true marasmus. But if the matter continues too long a time upon the surface of a large wound, it becomes attenuated and acrid by the heat and stagnation, so as to be absorbed again by the mouths of the veins, and infect the whole mass of blood with a putrid cacochymia, from whence again follow many of the worst consequences. But a seldom dressing of the stump will prevent too great a waste of the juices; and plentifully drinking of decoctions of vulnerary herbs will wash out the absorbed matter, and evacuate it either by urine or sweat: but when unexpectedly all the nourishment of the body runs impetuously to the surface of the wound, and is discharged in large quantities through the open vessels, there are but small hopes of a recovery. A man in the flower of his age had his leg amputated for a sphacelus, which he contracted in cleaning the bottom of a well in the midst of summer; and the operation happily succeeded without any supervening fever, his appetite was entire, and in the meantime he observed a proper regimen of diet, insomuch that the ends of the bones were now exfoliated, and the wound itself was almost brought to cicatrization, its whole surface being hardly larger in compass than a half-crown. But when every thing seemed thus to be in a fair way, and the patient enjoyed a perfect state of health, a whitish-coloured matter began to discharge itself almost like milk; which by degrees so much increased in quantity, that at length two or three pounds were found evacuated at every dressing; and at the same time a diarrhœa attended: by which two evacuations the patient was so much exhausted within the space of eighteen days, that he perished of a true marasmus. But yet no cause could be assigned for this disorder by the most skilful surgeons, who in joint consultation undertook the cure of the patient; nor could any remedy be found capable of suppressing this unhappy discharge of the nutritious juices from the wound and

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from the bowels ^b.

Another of the worst symptoms, which sometimes attends the most dangerous operations, is convulsions, which do not afflict the patient immediately, but sometimes invade a long while after, when every thing seems to be in a fair way. Thus Reverhorst, professor of anatomy at the Hague, relates, in an epistle to Ruysch ^c, That after the right leg was amputated below the knee, very expeditiously, in a maid of thirty-two years old, and the cure went on seemingly in a happy manner, yet the event was fatal; for there was continual and intolerable pains in the part affected, perceived in the same manner as if they were in the amputated limb that had been removed from the body, which is a circumstance frequently observed in amputations. In this patient the menses appeared before their due time, with violent pains in the bowels, and a continual looseness. But after these symptoms were gone off, she immediately began to complain of an uneasiness in the fauces and difficulty of respiration, which were ascribed to an hysteric fit to which this unmarried patient was subject. But, in a little time after, a pain and immobility of the neck, an impediment in mastication and deglutition, with a stricture or close shutting of the mouth, and a distortion of the muscles of the face, afforded a bad presage, notwithstanding every thing appeared well in the wound itself. These symptoms were neither relieved by internal nor external remedies; the fever grew more intense, a delirium came on, and at length death put a period to all these calamities. And the same excellent anatomist takes notice that he had observed the like symptoms several times in those who are afflicted with intestinal ruptures; and that they generally prove fatal in the end, notwithstanding the patient might seem in other respects to be in a fair way to health.

It is therefore evident from these observations, that a happy cure can never be promised in the greater operations of surgery, which are always dangerous, not only

^b De la Motte Traite complet de Chirurgie, Tom. III. p. 385, &c.

^c Ruysch, Epist. Anatom. Problem. 14. p. 6.

only in the performance itself, (as Celsus^d observes, fearing a deliquium or hæmorrhage), but even afterwards, when every thing seems to be in a fair way. The physicians and surgeons ought therefore to acquaint the patient's friends, that such dangers attend all amputations, however well they may be performed; lest they might be thought ignorant themselves of the danger, or seem to have been deceived. It is not without reason therefore that Hippocrates and Aretæus condemn as a fatal sign a convulsion supervening a wound. See the commentary on §. 233.

The best thing within the power of art, in these lamentable cases, is to relax the whole body, and more especially the affected part which is convulsed or in pain, by the application of soft oils, emollient fomentations, warm vapours, &c. as was recommended before in the commentaries on §. 234, n^o 3. from Hippocrates, Aretæus, Galen, and others. Parey^e relates a remarkable case, proving the efficacy of these remedies in a soldier, whose arm was amputated in the articulation of the elbow to remove a sphacelus which arose from a gun-shot wound: for in this patient convulsions followed fifteen days after the operation, in such a manner that the lower jaw was most strictly closed, and the lips and muscles of the face being distorted occasioned the risus sardonius. As the patient was destitute of all necessaries, and lodged in the uppermost room of the house, with his body exposed to the wind and cold from the badness of the covering, Parey ordered him to be carried into the stable, in which there was a great number of cattle, and a considerable quantity of dung. Burning coals being placed on each side his body, he rubbed the patient's neck, arms, and legs, with linen cloths; and laying some clean straw over a heap of dung, he then placed the soldier wrapped up in warm clothes upon the straw, and, after well covering his body, left him there for three days and nights. The moisture and warmth of the dung proved of so much service in his almost desperate case, that, after a plentiful sweat and a slight diarrhœa, the patient began

^d Lib. vii. cap. 33. p. 497.

^e Livre xii. chap. 37. p. 309.

gan to open his jaws a little, which were before most strictly shut by a stubborn cramp; and at length, from being reduced to the very brink of death, he recovered a perfect state of health.

§. 474. **I**F the patient who has thus lost a large limb, (466, to 471), has very strong chylicative and sanguificative viscera, in that case the symptoms of a plethora very often follow, (106); to remove the cause of which, bleeding is to be several times repeated, and a spare diet prescribed according to particular circumstances.

We sometimes see men survive a long time after they have lost both legs in battle, having had them carried away by a cannon-ball. In that case, what a considerable part of the body is removed, while all the viscera continue the same as when the person was well, and remain capable of performing all their actions! hence there is as much chyle and blood prepared from the indigested aliments as before the loss of those parts, which yet has much diminished the number of the vessels; and therefore the remaining vessels will be thus more distended and filled, that they may be capable of receiving the quantity of humours daily increasing. Thus by degrees all the consequent effects of a plethora must necessarily follow. And since the limbs after this misfortune remain incapable of their usual labour or exercise, from hence again the plethora will be increased, since there is daily a less consumption of the humours by the motion of the body being less than before. Nothing more therefore remains than to remove the too great quantity of juices by bleeding several times repeated, if the symptoms of an urging plethora return; but afterwards the quantity of blood drawn ought to be diminished, that thus the body may by degrees be accustomed to this sudden and considerable alteration made by the loss of limbs. At the same time such a diet is to be ordered as may be sufficient to support the body, and yet not increase

too much the quantity of humours. Unless these cautions are observed, there will be danger that the too much distended vessels will burst; whence may follow an apoplexy, spitting of blood, &c. unless their orifices dilating deposit or discharge the too great quantity of blood in parts less dangerous, as when a plethora is removed by a salutary bleeding of the nose, bloody stools, &c. Thus Galen observes, *That by reason of a plenitude of blood, the small mouths of the veins being opened into the intestines occasion bloody stools, in such a manner that the disorder resembles the piles; only with this single difference, that in the piles the seat of the disorder is in the anus, whereas in this case the veins are opened in the convolutions of the intestines, or even in the rectum itself, only in the beginning of it and at a considerable distance from the anus. But we see many afflicted with this disorder, who have had a limb amputated,*^a &c. But it is not in the power of a physician to cause an evacuation of the redundant blood, either by a rupture or a dilatation of vessels, in those parts of the body in which it may be with safety performed; and therefore there will be always danger of some fatal event. We know of no other way to draw off the redundant blood in such a case with safety, than by opening a vein. And unless the plethora is removed, either by nature or art, in those who have thus lost a considerable part of the body by amputation, it frequently happens, as Galen observes^b, that the blood flows either to the thorax or lungs, and then occasions a very bad disorder: for in that case either a peripneumony, pleurisy, or spitting of blood, must follow. And Bennet lays it down as a practical rule, among his observations, That those who are crooked or hump-backed, and such as have lost a limb by amputation, are
more

^a Quod ob sanguinis plenitudinem, osculis venarum in intestinis apertis, cruenta alvo exeant, sic ut fit affectus similis hæmorrhoidibus, in hoc uno divertus, quod illæ (hæmorrhoides) circa sedem nascantur, in hoc vero affectu venæ aperiantur in intestinorum anfractibus, vel etiam in intestino recto, sed longe ab ano, et circa ejus initium. Multos autem videmus hæc pati, quibus membrum amputatum fuerit, &c. *Commentar. 4. in librum Hippocr. de Articulis. Charter. Tom. XII. p. 450.*

^b Ibidem, p. 451.

more frequently troubled with defluations, and are in greater danger of a pulmonary consumption, than others ^c.

§. 475. **T**HE damage received by the loss of a limb is in part supplied by an artificial one formed by the instrument-makers, so as to resemble the natural one, by adapting proper machines together: concerning which you may consult Aquapendens, Hildanus, Solingen, Parey, &c.

It will be no difficult matter to adapt an artificial machine to the amputated limb, which may resemble the *shape* of the lost part, and which, being covered with a proper cloathing, will conceal the deformity. But by mechanics even the *use* of the lost part may be supplied in a surprising manner. For the muscles above the amputated part contract and swell by the influence of the will: To these muscles are adapted machines, by which (when the muscles swell, whose office was before to bend the joint) the same motions may be excited by the same ideas of the mind as was usual in the natural limb. Fabricius of Aquapendente has given an anterior and a posterior view of an entire skeleton made of iron. And the figure of such an artificial hand is represented by Parey^a, which he could scarce procure even with prayers from one of the most skilful artists; and in the same author there are several other figures of the like nature.

Of B U R N S.

§. 476. **I**F actual fire, or any thing which conceals fire, is applied to our bodies, there follows a destruction of the small vessels in the part, and an extravasation of their humours, varying

^c Theatrum Tabidorum, p. 108. ^a Livre xxii. chap. 12. p. 580, &c.

varying according to the difference and duration of the cause, and the nature of the affected part.

In the healthy human body there is a certain degree of heat, to be measured by the thermometers; which degree of heat offers no injury either to the solids or fluids: This heat seldom exceeds the ninety-sixth degree of Fahrenheit's thermometer, even in the strongest men. But when the heat of the body ascends above the hundredth degree in diseases, the blood and its serum then begin to be disposed to coagulation; but if the degree of heat in the body is equal to the hundred and twentieth degree of the thermometer, the serum of the blood coagulates. Heat therefore, raised to so great a degree, changes the disposition of our juices, though the solid parts do not as yet seem to be much affected. But when the heat is raised equal to that of boiling water, which is usually about two hundred and twelve degrees, then the solid parts are injured, many of them being dissolved: for if water that is boiling, or near upon boiling, be applied to any part of the body, it instantly ruptures many of the small vessels which connect the skin and cuticle together, from whence the humours are extravasated, and, being collected together, raise the cuticle into a blister. But when the heat applied to the human body is greater than that of boiling water, it destroys a greater number of vessels, and that almost instantly; as for instance, a red hot iron in a moment consumes any part of the body which it touches.

But the fire, which is applied to the body either burns and shines; as for instance, in the flame of a candle, or a burning coal, &c. Or else it is concealed in bodies, so as not to shine, and yet to burn up every thing which it touches: as for instance, when an iron is heated so hot as to kindle brimstone, or destroy the soft parts of our bodies down to the bones, and yet there are no signs either of light or burning in the iron itself; in this case the fire is said to be concealed in these bodies, notwithstanding it produced such sensible effects. These effects may be reduced to a de-

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struction of the small vessels, an extravasation of their juices, and a coagulation of them. Thus for instance, if boiling water touches any part of the body but for a few moments, the small vessels are ruptured under the cuticle, and their extravasated juices are collected into a blister; but the skin, and often the panniculus adiposus placed under the cuticle, are so much altered by the boiling water, that their juices being coagulated, all the vital influx and efflux of the humours to and from those parts is intercepted, whereupon a gangrene or suppuration succeeds, by which it is necessary to separate all the parts thus injured. When a hot iron is applied to any part of the body, it immediately forms a hard and dry eschar; and yet there will be no appearance of the extravasated juices immediately in the burnt part, even notwithstanding the vessels are destroyed: the reason is very evident, because the same action of the fire coagulates the juices. So that the effect of a slight burn is an extravasation of the humours; but by the more violent action of the fire both fluids and solids are converted into a dry crust.

But the effects of fire applied to the body differ according to particular circumstances. Fire, indeed, seems to be in its own nature one and the same thing; but it is very rarely that pure fire can be applied to any part of our body, since it is generally lodged or contained in other bodies. Even the flame of the most pure alcohol is not simple fire, but there is water taken up into the flame. The rays of the sun collected by burning-glasses are alone pure fire; whereas, in other experiments, fire always requires fuel to support it, or else it is united to other bodies. But those bodies which contain fire in themselves, or which afford fuel to the burning fire, are said to be the causes of those effects which in this manner arise from the application of fire to any part of our bodies. And in these causes are observed a great difference, to be determined only by experiments: as for instance, a person may move his hand through the flame of burning alcohol almost without injury; but if it was to be moved thro' burning wood or sticks of oak, the hand would then be instantly

stantly burned. Besides this, we discover that some fluids are capable of receiving and retaining a much greater degree of heat and fire than others. Water placed over burning fire, hardly heats beyond the two hundred and fourteenth degree of Fahrenheit's thermometer; and when once the water has acquired this degree of heat, it cannot be heated to any greater degree, however much the fire be increased beneath the water. But oil-olive, and linseed oil, or the like oils expressed from seeds or fruits, cause the mercury to ascend in the thermometer to the six hundredth degree when they boil; whence we observe a great difference in the effects produced when any part is burned by the application of boiling water or scalding oil.

Duration, &c.] For in proportion as the fire continues to act a longer or shorter time upon the part, it is evident that the effects will be increased or diminished. A hot iron applied to the skin but one moment and taken off, will indeed burn it, but very slightly; whereas if it is pressed a longer time upon the part, it will destroy all down to the bone. Hence burning with boiling pitch is much more dangerous than with oil; because by its tenacity it very firmly adheres to the skin, whereas oil much sooner runs off.

Nature of the affected part.] But the different nature and action or use of the affected part in the body, will again make another difference in the effects of fire. Those smiths who are daily employed in making of anchors, have the palms of their hands extremely hard and insensible like horn, insomuch that they are capable of holding burning coals, or even iron hot from the furnace, without danger; but the same smiths, when they lie sleeping by the fire-side, after they have been tired by their day's labour, have the skin of their legs often burnt, and raised into a blister, by a small particle of such fire. When a citizen of the Hague was blowing with his mouth into a musket, the piece being charged, unfortunately took fire, the man not knowing that it was loaded; and by this accident his palate, gula, gums, and tongue, were miserably burned, insomuch that he was not able to swallow any

thing for the space of eighteen days, though bleeding and other proper remedies were used; and the dead parts afterwards separated from the living, which being extremely painful and sore, created much misery to the patient, till at length some fragments of bones being also separated from the palate, he did well, and gained the better of death after a hard struggle^b. But it is very evident, that a burn would be much less dangerous and troublesome, provided the hand, instead of the mouth and gula, was to be burnt with gun-powder.

§. 477. **T**HE different degrees of these several effects from burning (476) resemble those observed from the first and slightest degree of an inflammation, till it degenerates into the worst or most severe sphacelus (370 to 464.)

Whatever was the cause which contained and applied the fire to the body, or however long or short might be the continuance of its application, or lastly to whatever part of the body the fire is applied, the effects thereof will indeed be various, but always like those which are observed in the different degrees of inflammation in the same parts; for the most intense fire, destroying any part of the body, does no more than a sphacelus which corrupts the whole. But a slight action of the fire, though uneasy or troublesome, does no more than excite a kind of redness and tumor almost like an erysipelas: upon increasing the fire, the tumor and redness will be increased, so as to produce a true phlegmon: if the fire be still augmented, blisters will be raised, and all the signs of a gangrene from a violent inflammation will appear: and lastly, by fire, all the parts may be destroyed down to the bones, as happens in a true sphacelus. But it was said before, in the commentary on §. 370, that a phlegmon derived its name from fire, on account of the similitude between the effects of both. But there may be as many different degrees betwixt the smallest and the greatest burn, as there may be intermediate degrees betwixt the

^b Stalpart. vander Wielen Observat. Rar. cent. 1. obs. 24. p. 100.

the slightest erysipelas and the most perfect sphacelus. In short, almost the only difference is in the celerity of the action of fire; since by the application of this last a perfect sphacelus may be produced in an instant of time, which yet always follows, but by slow advances, even after the most severe inflammation.

§. 478. **H**ENCE the phenomina or symptoms, the diagnosis, and the prognosis, are the same in both.

From what has been said, it is evident, that the symptoms of burning are the same with those which accompany inflammation. But as inflammation has different ways of terminating, according to its magnitude or degree of intensity, so as to render a different method of cure necessary, as we observed in the history of inflammations; so the very same likewise takes place in burns: and therefore we ought to be acquainted with the signs which denote the different degrees of burning. But the knowledge of these signs appertains to the diagnosis of the disorder. A slight burning is known from being acquainted with its cause, which was neither violent, nor applied for a long time together: as for instance, if water, which is not yet scalding, touches the body only for a moment, there follows only a slight redness and painful tumor of the skin, with few or no blisters; or if any, they do not arise immediately after the burn, and are full of limpid water; which absolves the diagnosis of this degree of burning. But a worse degree of burning is known from an acquaintance with its more violent cause, or its longer continuance, with the intensity of the pain, and the sudden appearance of blisters full of a yellow liquor immediately after the burning, followed with a tensity or rigidity of the skin round the burnt part. But in the worst kind of burning, where all the vessels are suddenly destroyed by the violence of the cause, there do not appear any blisters in the burnt part itself, but yet there very often arise blisters in its circumference,

ence, the skin turning livid, or sometimes quite black, but giving no sign of any sense of pain, although cut or punctured by the scalpel, being hard and quite dry.

But the prognosis depends upon knowing the nature or degree of the burn by its diagnostic signs, considering also the nature of the injured part, and the habit of the patient. And here physicians and surgeons ought to be more particularly cautious not to promise more than they are able to effect. For where the burn is only slight, the cure may be performed without leaving any scar. But if the vessels are ruptured, and the humours extravasated, or else congealed by the force of fire, the circulation will be then entirely suppressed in the part, and a suppuration will follow all round the parts which ought to be separated: whence that surgeon will be grossly mistaken who promised an easy cure of such a burn without a scar; for a separation of the dead parts will leave a hollow ulcer, whose lost substance can seldom or never be so far repaired as to render the surface equable with the rest of the adjacent skin. Now, according as the part burnt is of a more tender or firm structure, the prognosis will be again on that account various: as for example, there will be always great danger of injuring the sight, even by a slight burn inflicted near the eyes. In atrabiliary, cacochemical, and scorbutic people a slight burn frequently degenerates into a most stubborn ulcer. Attendance must be therefore given to all these particulars in the prognosis, lest the bad consequences following should be ascribed to the physician or surgeon, if he takes no notice that such accidents are to be feared.

§. 479. **B**UT in the cure also there is no difference; and more especially the antiphlogistic drinks, proper for inflammations, are always necessary in burns.

For in the same manner as no general method can be prescribed for the cure of inflammation, but the means are to be varied according as it tends either to a resolution,

lution, a suppuration, a gangrene, or a scirrhus; so also, in burns, a very different method of treatment is required when it stops within the limits of a resolvable inflammation, than when the fire has destroyed or converted the part into gangrenous or dead eschars. In the following aphorisms we shall therefore prescribe the method of cure proper to each degree of burning: by which it will appear, that this disorder also corresponds very much to the curative indications enumerated in the history of phlegmons; insomuch that there is but one remedy that can be universally recommended in all the species of burns, namely, the use of a thin antiphlogistic or cooling drink. For there is a degree of inflammation, which accompanies even a slight burn. But in the more intense burns, especially if a large part of the body has been injured, all those remedies will be convenient, which we recommended before for the cure of a violent phlegmon; and more especially bleeding, repeated according to the nature of the case, with antiphlogistic purges, will be of the greatest use. By these means Hildanus^a happily cured a dyer's servant that fell into a copper full of hot dye, which was not yet scalding; and, by the external application of the best topical remedies at the same time, the slight scalding of the whole body was healed in the space of fourteen days; which yet appears from the history not to have exceeded the limits of a resolvable inflammation, except in a few parts of the body, which touched the oak-chips and other hard materials lying next to the bottom of the copper; to which parts a different method of treatment was used, as Hildanus informs us. At least it is evident from this instance, how serviceable those means may be for the cure of burns, which were recommended before for the cure of a resolvable inflammation.

§. 480. **B**URNING or scalding, within the limits of are solvable inflammation (386), is to be treated with such remedies as preserve or
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^a De Combustione, cap. 7. p. 922.

as it were pickle the juices, and put them into motion, and by such things as open and preserve the vessels: and this is performed by the application of a moderate degree of fire, by fomentations and cataplasms (395 to 402), by washed butter, or lastly with spirit of wine and a little vitriol.

If a burn has hurt but a small part of the body, there will be no necessity to disturb the whole by bleeding and cooling purges, &c. for in that case it may be sufficient to treat the part itself with topical remedies. When the burning has been so slight, as only to cause a resolvable inflammation in the part, the cure is then easy enough, even by most of the different remedies which are kept in families for that purpose. But what seems not a little surprising, is, that even the best surgeons should recommend medicines of opposite virtues in these accidents, namely, emollients and astringents, attractives and repellents, &c. Thus Parey^a recommends the juices of house-leek, lettuce, plantain, &c. mixed up with the white of an egg: and in the same place he recommends for the same disorder a mixture of clay and vinegar, or writing-ink mixed with oxycrate, or roach-allum dissolved in water; and observes, that the acrid bulbous roots of onions, beat to a cataplasm with a little salt, are applied with very good success. I have also observed several other things applied in these cases, to the great relief of the disorder, provided the application of them is frequently repeated. And this is a caution given almost by all surgeons, that, at the beginning, the remedies applied to the burnt part ought to be frequently renewed, until the pain is abated, or, as Parey^b expresses it, till the heat or fire of the part has been drawn out. Hildanus mentions, that his wife happened inadvertently to dip her hand up to the wrist into boiling soap; when instantly a violent pain followed, not only in the hand, but throughout the whole arm. He immediately washed off the soap with warm water; and then anointed the part with a liniment made up of raw onions, salt,

^a Livre XII. chap. 17, 18. p. 300.

^b Ibid.

salt, soap, oil of sweet almonds and of roses, mixed together; the arm also was anointed with oil of roses, and the whole invested with a bandage dipped in vinegar and water: and he adds, that he often repeated these means; and with so good success, that no ulceration of the skin followed so violent a scald, except a small pustule in the thumb, and another in the forefinger, which yet were easily cured with only a little unguentum basilicon ^c. In another case he says, that he renewed emplasters four times every hour for the first day, and by that means drew out the greatest part of the fire ^d. Thus, therefore, there seems to be many remedies capable of curing this degree of burning, provided they are such as preserve the stagnating humours from corrupting, and put them into motion, while at the same time they preserve the continuity of the vessels, and render them pervious. It may be asked, whether fire, applied to any part of the human body, does not remain united to it for a time? and whether it may not be therefore extracted by attractive remedies, in the same manner as the freezing spiculæ are drawn out of frozen bodies by the application of snow or cold water? Certain it is, that, barely by a prudent application of fire, the pain is abated in the burnt part, and at length totally removed. Hence Fernelius ^e has very well pronounced, that fire itself, applied near, is its own antidote to drive out the fire of the burnt part by which the pain is abated. He adds, that some remedies applied to the parts, entice out the fire; thus he says, that the leaves of leeks and arum or wake robin make a present remedy for a burn: and soon after he exhibits a numerous catalogue of medicines which serve to the same intention, tho' their medicinal virtues are very different from each other. I have frequently seen, that the mere application of warm water, or anointing with unguentum populeum, or the like, has relieved the pain in the burnt part; and when the pain has increased again in a little time afterwards, it has been a second time re-

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^c Hildan. de Combust. cap. 6. p. 922.^d Ibid. cap. 6. p. 927.^e Therapeut. lib. vi. cap. 20. p. 453.

moved by the application of linen cloths moistened with warm water, or by renewing the unction with the same liniment; and thus, by repeated applications of the same remedies, all the pains have by degrees vanished. Whatever may be the truth concerning that property of fire, which I before proposed only as a doubt, it is sufficient for the practical physician to be acquainted with those remedies which safely and certainly ease the pains attending burns, and which perfectly cure the disorder. Experience has taught us, that these intentions may be answered by the following means.

A moderate degree of fire.] If, for example, the right hand happens to be burnt, the left hand is to be moved towards the fire till it arrives at such a distance as renders the heat very agreeable to the sense of feeling; and then the right hand is to be applied at the same distance from the fire, whereupon the pain will at first increase, but will soon after diminish again; and upon advancing the right hand a little nearer to the fire, the pain will again increase, and soon after vanish; and thus an approach is to be made by degrees, till the right or burnt hand is capable of bearing the heat of the fire at the same distance in which the left or sound hand can support it without uneasiness. When this has been done, the burn is cured; and the usefulness of this method is approved by daily experience, the burn being then usually said to have had its fire drawn out.

By fomentations, cataplasms, &c.] In the *Materia Medica* corresponding to this aphorism, there are several forms of this nature, and many more such may be composed and applied. But all of them are most serviceable when applied warm (for things actually cold are observed to be mischievous in burns), and frequently renewed until the pain is eased. The saturnine emplasters, with liniments of the like kind formed with the calces of lead, and with the softest oils of any kind, will be likewise equally serviceable. But spirit of wine, we are assured by Sydenham^f, is preferable

^f De Peripneumonia Notha, in fine pag. 343.

ferable to any other remedy as yet known: Linen rags are to be dipped in it, and immediately applied to the burnt parts, and the application repeated fresh every little while, till the pain is entirely removed; and then he would have the application repeated only twice in a day. It is to be here observed, that this great man recommends the frequent application of the same remedy in the beginning of the disorder. It will be also serviceable to add a little vitriol to the spirit of wine, or else alum, or the like astringent and repelling substances which have been recommended by Parez and others. Perhaps these remedies exert their efficacy by preventing the blood from passing into the smaller vessels, and by constringing the vessels, so as to propel their contents from the smaller towards the larger capacity of the tubes, and by that means resolve the inflammation there seated. But all these remedies, however celebrated, are only serviceable where the burning has produced a resolvable inflammation; for if the vessels have been so far destroyed, or their contained juices coagulated to such a degree, that there is no room to expect a resolution of the concremented parts, nor a possibility of restoring the stagnant juices to their proper motion, in that case another method of cure is required, as we shall explain in the following aphorisms.

§. 481. **A** BURN which tends to a gangrene, as may be known from the skin being already turned into a crust, or else eroded and elevated into blisters, is to be treated as an inflammation of the same nature, namely, by fomentations and cataplasms of emollient and digestive remedies (402 to 454).

When the signs mentioned §. 478, denote the burn to be so great, that it cannot be cured by a mild resolution, but threatens to turn into a gangrene; in that case, all those remedies are proper which we recommended, in the aphorisms here cited, for an inflammation

tion of the same nature. In this case, then, that mild suppuration is to be promoted, which separates all those parts of the solids and fluids which had been so altered or changed by the fire as to be no longer obedient to the laws of life and health; and this is to be done by the application of the most emollient cataplasms and fomentations. But it is to be observed, that the rising of blisters in the burnt part does not always denote a gangrene to be present; for if they appear immediately or only after a few hours time, and are turgid with a thin limpid water without any apparent dryness or hardness of the subjacent and contiguous skin, there is not as yet cause to despair of curing such a burn without suppuration. For I have frequently observed the connection betwixt the thin cuticle and subjacent skin to be dissolved, when at the same time the latter has not been much injured, and the burn has been cured without any suppuration or remaining scar. Parey and Hildanus advise the opening of the blisters immediately, that the contained ichor may not corrode and ulcerate the subjacent skin. But I have frequently observed, both in myself and others, that no bad consequences followed from leaving the blisters entire: for then the extravasated humours are not so soon corrupted; and the cuticle being whole defends that tender nervous pulp which lies underneath, and is so extremely painful when uncovered, from being injured by the air or any of the applied remedies; for every one well knows, how extremely painful it is to have any part of the body touched from whence the cuticle has been abraded, for then a very acute pricking pain follows. It is also usual for the water contained in these blisters to be absorbed or dissipated; and when the subjacent skin is covered with a new cuticle, that which was elevated into blisters spontaneously separates of itself without any pain. But if the subjacent skin has been so far injured, that the inflammation becomes irresolvable, and can be only terminated by suppuration, it will then be best to make a small opening in these blisters, leaving the cuticle upon the part, which never corrupts nor occasions

any injury; whereas if the collapsed cuticle was to be immediately cut off, as is frequently done, the surface of the naked skin will be extremely painful. This has been well remarked by Parey^a, who says, that deep burns are less painful than superficial ones; and he cautions surgeons in these cases to cover the painful parts only with soft lint, that they may not be irritated by a rough handling when the wound is cleansed. The like caution is also recommended by Hildanus^b as to these superficial burns of the skin; whose method was to cover the burnt place with a piece of cambrick, which he did not remove till the part was healed. But certainly the cuticle left on will afford a more natural and easy covering.

When, therefore, a suppuration is necessary to be promoted, in consequence of a burn having an irresolvable inflammation, those emollient cataplasms and other remedies mentioned at §. 402 *et seq.* when treating of abscesses, will be serviceable. And altho' there shall be no deep ulcer formed, but only a separation of the cuticle, yet there will be very often a large quantity of matter discharged from the surface of the burn daily; and thus by degrees the disorder will be cured. Hildanus was much surprised at this, when he had the cure of a maid, who had scalded her whole leg up to the thigh with water. For at every dressing, which was made twice a-day, he found above half a pound of white, uniform, well-concocted matter lodged in the linen cloths and emplasters which were taken off; and this very copious discharge continued for many days, even though nothing but the cuticle was separated, and there was no deep ulcer, much less any gangrenous eschars^c. The cure of this scald by suppuration was completed within the space of five weeks.

But since the burning cause does not always act with the same violence upon every point of the flesh which it touches, we therefore frequently find that the inflammation is in some parts resolvable, and in others

^a Livre xii. chap. 18, 19. p. 301.

^b De Combustione, cap. 7.

p. 924. ^c Observ. Chirurg. cent. 4. obs. 93. p. 372.

not at all; whence different remedies are to be applied to different parts, according to the nature of the circumstances: as for example, when scalding water falls upon some part of the skin, that part which it runs over first will be injured more than the adjacent skin which it passes over afterwards. Hence in that case (mentioned §. 479.) of the dyer's servant who fell with his whole body into water almost scalding, Hildanus anointed almost the whole body with a mixture of salt, soap, crude onions, &c. formed into an ointment; but to some certain parts where the burn penetrated more deeply, he only applied the most emollient remedies. But bleeding, cooling purges, and the use of diluent medicines, can be never prejudicial, even though a resolution can hardly be expected, in the most violent burns: Since by these means, speedily applied, and discreetly repeated, even an incipient gangrene is often happily cured, (as we observed at §. 441); more especially when the face is burnt, from whence a disagreeable scar or disfigurement might be feared as long as the patient lives, or even sometimes blindness itself, when the eyes or their adjacent parts have been thus injured. A misfortune of this nature once happened to the celebrated author of these aphorisms, when, by the bursting of Papin's machine or digester, the most scalding water flew into his face, and penetrating thro' his clothes miserably scalded his arm. His whole face was in a little time blistered; and his eye-lids so much swelled as totally to obstruct his sight, insomuch that he could not distinguish even the light of a candle. He immediately ordered himself to be bled *ad deliquium*, and the next day caused the phlebotomy to be repeated; and afterwards took a pretty strong purge, even although he was reduced nearly to a state of fainting by the slighter purges. He took care to have his face anointed only with *unguentum nutritum*, and covered with *emplastrum ex lapide calaminari*. After these profuse evacuations, the tumour of the parts subsided; and by the use of a thin diet and plentiful drinking of cooling liquors at the same time, the cure of this dangerous scald was so happily advanced, that after eight

or

or nine days time he appeared again in public, with his eyes saved from so great a danger for the great benefit of mankind in general. But yet an unsightly scar remained in his arm, after a tedious suppuration; for there the scalding water insinuating into the cloaths, continued to be applied for a longer time to the skin.

§. 482. **A** BURN which has already produced gangrenous eschars or a perfect mortification of the parts, is to be treated like those disorders (419, to 476.)

But when these vessels have been so much destroyed by burning, or the humours so much coagulated, as entirely to intercept the circulation of the juices thro' the affected parts, a true gangrene is produced; and, if the disorder penetrates to the bone, a sphacelus or perfect mortification itself is present. Every thing therefore which has been proposed for the cure of those disorders in the aphorisms here cited, will be serviceable in the like injuries arising from burns; namely, a separation ought to be made of the dead and corrupted from the living parts. In these cases it is evident, how vain the boastings of those are, who give out, that, by their secret remedies, they can cure all manner of burns in a short time without leaving any scar. Many such deplorable cases as these daily occur: and I have almost constantly observed, that when boiling water falls upon any part, it generally excites a gangrene in the place where it first touched; whereas the rest of the parts are less burnt, over which the water passes successively after the former. If, now, the cuticle be perforated in a blister raised upon such a part, there appears underneath an ash-coloured or yellowish spot, which is truly a gangrenous eschar; and requires, by the same rules, to be separated from the living parts by suppuration, as in a gangrene arising from other causes, as we explained it before in the commentary on §. 444. But if any part of the body is burnt by actual fire, the eschar is formed so thick and hard, as very often to require deep scarifications, in order to set

at liberty the subjacent sound or living parts from this dead incumbent crust. Only the most emollient ointments can be in that case serviceable, with cataplasms and fomentations of the like nature; and all desiccative or astringent remedies will be prejudicial. Even spirit of wine, which is so much recommended by Sydenham and others for the cure of all burns, will in this case not only harden the eschars, but also retard the cure, and frequently augment all the bad symptoms. This appears very evidently from an unfortunate case related by the incomparable Le Motte^a, whom we have so often quoted. A girl, seized with an hystERIC fit, fell with her face into the fire; and when she endeavoured by the extremity of the pain to rise up, she fell backward again into the fire; so that her whole face and throat down to the breasts before, and her neck down to the shoulders behind, were burnt in a miserable manner. Soon after, linen cloths dipped in the spirit of wine were applied to the burnt parts; and this treatment was continued for three days: but the pain increased; and the blackness which appeared on the first day extended itself every way, together with an intolerable cadaverous stench. By good luck, her face was least burnt, and her eyes not injured; but from her chin to the breasts, and from the nape of the neck to the lower angle of each scapula, there was nothing but a mere dry and gangrenous crust. Deep scarifications were made throughout the whole extent of this violent burn; and the incisions were filled with a solution of *unguentum aegyptiacum* in spirit of wine, applying afterwards compresses dipped only in spirit of wine. But yet all the parts continued very dry, and no signs appeared of any consequent separation. Therefore these remedies being laid aside, the before-mentioned surgeon covered the whole surface of the burn with very soft ointment composed of yellow wax, oil-olive, and the yolks of eggs first hardened by the heat of burning coals till they were in a condition of crumbling. This dressing had not been applied for three days, before all the parts began to appear moist, and soon

^a Traite complet de Chirurgie, Tom. III. p. 388, &c.

soon after the dead and foul eschars began to separate, so that in the space of a month the whole wound appeared clean; but yet it took up above four months time to bring this dangerous burn to heal and cicatrize. The same author gives us several cases of the like nature, from whence it appears that only the most emollient remedies are useful in such burns. The like remedies are also recommended in these violent burns by Hildanus^b. But when all the soft parts have been destroyed by fire or burning even to the bones, nothing then remains but amputation, as in a sphacelus. Of such a burn there is an instance given by Le Motte in the place before cited.

It is therefore evident, that the cure of a gangrene and sphacelus does in this manner very much coincide with these burns; and that it ought always to be mentioned in the prognosis, that they cannot be cured under a long space of time, and will always leave a disagreeable scar behind them.

§. 483. **B**UT there is no wound which requires more care to procure a smooth, uniform, or slightly cicatrix, than a burn, (see §. 217.)

What a cicatrix is, has been already explained in the commentaries on §. 217, where we treated of the cure of wounds; and where it was also observed that the most perfect cure of wounds is when they are healed up without any scar remaining. But if this cannot be obtained, then the most slightly scar is said to be that in which the remaining mark of the wound appears afterwards to be as much as possible like the adjacent skin. We also observed in the same place, that there are three things principally necessary to produce an uniform, small, and slightly scar; namely, to unite the parts in the same state or collocation which they had before they were wounded, and not to let the lips of the wound either project beyond or sink below the surface of the skin. Since therefore very unsightly scars are so apt to remain after the cure of burns, all possible care must be taken to prevent this deformity as much

as lies in the power of art. In that species of burns which falls within the limits of a resolvable inflammation, and in which the cure may be compleated without any consequent suppuration, there will not remain any scar; whence the ignorant believe that it is possible to cure all burns in this manner. But when a violent suppuration or a gangrene following after a burn has consumed the skin and panniculus adiposus, it is then one of the greatest difficulties to cure such a wound without a deforming cicatrix. If indeed the scar remains in a part which is usually concealed by the clothes, it would be matter of no consequence; but when the face has been burnt, and more especially in the fair sex, all the endeavours of art should be employed, that, if a scar cannot be avoided, it may be rendered as slightly and agreeable as possible. But since the clear skin of a cicatrix adheres to the subjacent muscles or their tendinous capsules, after the panniculus adiposus and skin have been consumed, therefore that part will be almost constantly hollow, and more smooth or shining than the rest of the adjacent skin. The chief assistance which art can give in this respect is, to treat the burnt parts with the most emollient and moistening remedies, until the cure is completed; that by these relaxing remedies the vessels may be more elongated, and renew or fill up more of the lost substance. All things therefore which dry up, corrode, or astringe, are to be carefully avoided, and such things applied as in other cases promote the growth of proud flesh. But great circumspection is necessary in this business: for sometimes the whole surface of the burnt part has not been equally injured by the fire; so that to apply the most emollient remedies to the whole surface of the wound, would occasion some parts to grow up beyond the rest, whence a very unsightly scar would follow. The whole surface therefore of the burn is to be accurately inspected; and more or less of the emollient remedies applied, according as they are found necessary. It is not therefore in the power of every surgeon to induce a slightly scar over any burnt part of the body. Hildanus even orders the scar to be fomented daily with

with the most emollient decoctions, or with some soft ointment, whenever it appears harder and rougher than it ought; and if it protuberates in any part, he orders it to be depressed with a plate of lead that has been anointed with crude mercury^a. The same author also observes, that the surgeon ought to extend the contracted and indurated skin with his hands every day after the unction, that by this means the deformity of the scar may be removed as much as possible. If all these means are insufficient to correct the deformity of the scar, he advises to cut it out, then to remove the lips of the recent wound from their mutual contacts by the application of splints, and then to promote the incarnation with the most soft or mild balsams. But since a scar is never more unsightly than when the parts conjoin together out of their natural situations, and as that argues either ignorance or neglect in the surgeon, it ought to be avoided as carefully as possible. Hildanus^b relates, that an infant, of only six months old, burnt its left-hand in such a manner, that all the extreme joints of the fingers except the thumb were disjoined; and the cure of such a dangerous burn being left to unskilful people, the fingers were bent backward, and adhered to the back of the hand, which had been also burnt, so that they grew together. Since all the use of the limb was thus destroyed, and the hand, being contracted into a ball, afforded a disagreeable spectacle; the father of the infant consulted Hildanus six months after the burn was healed. This expert surgeon applied the most emollient fomentations and ointments for some days, to relax all the parts: then with a razor he divided the callous cicatrix which connected the fingers to the back of the hand, and likewise separated them in the same manner from each other; and afterwards, by an ingenious apparatus, he contrived to retain the fingers in their natural situations, in the manner which he illustrates by a figure. I saw the lower eye-lid concreted together with the cheek, after burning the face; from whence a frightful lippitude remained as long as the patient lived.

From

^a De Combustione, cap. 14. p. 991.

^b Ibid. cap. 15. p. 952.

From all that has been hitherto said, it is evident, that great skill and dexterity are required in the surgeon in order to cure great burns without any considerable deformity or defect in the use of the parts remaining afterwards; and that very often incurable evils follow, when unskilful people trust to the efficacy of boasted medicines for the cure of violent burns, which medicines are only sufficient for the cure of slighter accidents.

Of a SCIRRHUS.

§. 484. **A** SCIRRHUS (392) is caused by any thing which coagulates, inspissates, or dries up the juices in a gland: And its seat is therefore every gland; but more especially those which have their juices more inclined to inspissation, or which from their situation cause the juices to stagnate longer. Hence this disorder more frequently takes place in the eyes, nose, mouth, breast, arm-pits, groins, pancreas, mesentery, uterus, &c.

We come now to the last method of terminating an inflammation, namely, when it is not resolvable, nor yet separates the vitiated from the sound and healthy parts (§. 392.) even notwithstanding the motion of the vital juices is not maintained agreeable to the laws of health either in the fluid or the solid parts. But as, in treating of a gangrene, we included not only that species of the disorder which arose from violent inflammations, but also included all those which proceeded from any other causes; so, in like manner, we shall here describe the history and cure of a scirrhus in general.

Galen^a, in treating of the different kinds of tumours, says, that such as are hard and without pain, are called by the name of *scirrhus*; and he gives much the

^a Comment. in Aphor. 34. sect. 4. Charter. Tom. IX. p. 155. et Comment. 1. in text. 2. lib. vi. Epid. Hippocrat. ibid. p. 356.

the same definition in many other places of his writings, so that this seems to have been his general idea of a scirrhus: but in some places he gives a description of it something differing from the former; as when he says, *A perfect scirrhus therefore is a preternatural tumour, hard, and destitute of sense; but an imperfect scirrhus is not absolutely destitute of sense, only perceives or feels with much difficulty. That scirrhus therefore which is destitute of sense, is incurable; but that which has a dull sensation, though not absolutely incurable, is yet very difficult to cure*^b. But that Galen does not use the word *αἰσθητός*, *insensible*, with the same meaning, or to signify the same with *ἀναισθητός*, *indolent*, evidently appears from another passage, where he says, *We give the name of scirrhus to a hard tumour which is without pain, yet not destitute of all sense; for such a one would be incurable*^c. From all which this at least is evident, that hardness and absence of pain accompany every scirrhus; and that, in the worst or incurable species of these tumours, according to Galen, there is also an insensibility.

But Galen describes these scirrhosities or indurations as seated not only in glands, but in other parts of the body. For, in treating of the cure of a scirrhus^d, he recommends the virtues of vinegar as safe and effectual where the muscular or fleshy parts are indurated into a scirrhus: but he would have vinegar to be used more cautiously when the scirrhusity is seated in the tendons or ligaments. He even observes, that by the use of too cooling and astringent remedies after an erysipelas, a scirrhusous tumour was left in the thigh of a child incurable^e. For it cannot be denied but that these preternatural indurations are seated in other parts of the body as well as in the glands; which parts ought therefore

^b Exquisitus igitur scirrhus tumor est præter naturam, sensu carens, et durus. Non exquisitus autem non omnino quidem sine sensu est, sed ægre tamen admodum sentit. Qui igitur sine sensu, incurabilis est; qui vero hebetis sensus est, non quidem insanabilis est, tamen non facili curatu. *Meth. Med. ad Glaucon. lib. ii. cap. 6. Charter. Tom. X. p. 378.*

^c Scirrhum nominamus tumorem durum, qui sine dolore est, non tamen omnino sine sensu; talis enim sanabilis non est. *Ibid. lib. xiv. cap. 6. p. 324.*

^d *Ibid. cap. 5. p. 323.*

^e *Ibid. lib. ii. cap. 6. Charter. Tom. X. p. 378.*

therefore to be called scirrhus, according to Galen's general definition: but then these last kinds of this disorder terminate very differently from the former, and do not so easily degenerate into a cancer; and therefore, perhaps, they may be more properly distinguished by the name of *scirrhus tumours*.

But the seat of a *scirrhus*, properly so called, seems to be always some gland or hollow receptacle, upon the membranous sides of which all sorts of vessels are disposed: into the cavity of which receptacle a particular humour is deposited from the open mouths of the smallest arteries, from the blood brought by the arterial fabric destined to the secretion; and being afterwards collected by the emissary of the gland, it passes out from its cavity, and serves for various uses in different parts of the body. Of these simple glands there are a great number, which convey the humour collected in their cavities towards the external skin, or to the surface of the other membranes, as into the cavities of the nostrils, mouth, fauces, wind-pipe, œsophagus, &c. But if a great many of these follicles or simple glands are conceived to be united together, the emissaries of all which terminate in one larger canal, where the humour of each is collected and conveyed for particular uses; in that case the assemblage of these smaller glands invested in one common membrane, and terminating in one common emissary, is called a *compound gland*, or, according to some anatomists, a *conglomerate gland*; as, for example, the parotid and other salival glands, which separate the juices of the mouth from the blood, and transmit them by common excretory ducts into the cavity of the mouth, are thus called. But concerning these, see what has been said by Boerhaave in §. 241 *et seq.* of his Medical Institutions.

All those juices, therefore, which are separated by the fabric of the gland, and collected in their cavities, may by coagulating or inspissating become so impervious, dry, and indurated, as to be no longer capable of passing out of the gland by the proper emissaries, but being confined within the gland may give rise to a *scirrhus*.

rhous. The same disorder will be likewise produced by every cause which obstructs the emissaries of the glands by an external compressure in such a manner as to prevent their contained juices from being discharged. For in this case the follicle of the gland is distended by the confined juice, while the thinnest part only is absorbed by the open mouths of the small veins, or else discharged by the obstructed emissaries of the gland itself; and thus the grosser parts being collected, and distending the follicle, will compress the small vessels dispersed through the membranes of the gland; whence will follow a tumour and hardness from an infarction of the vessels with coagulated, inspissated, or dried juices; and the nerves, which are dispersed through the fabric of the gland, being also compressed, the gland will be indolent or without pain: and hence it is, that a scirrhus altogether insensible is incurable, as we are told by Galen. But the same disorder may also arise in other parts of the body, where there are only arteries interwoven, without the intervention of follicles or cells, the secreted humour being collected in some common receptacle: as for instance, in the testicles, the artery which conveys the blood, transmits the same blood to the corresponding vein; and then divides into an infinite number of small branches, which compose almost the whole substance of the testicle, and open with their ultimate extremities into one common receptacle, which receives all the particular humours separated from the blood by the fabric of the gland. If now by any cause the free discharge of any such humour is obstructed, it will be collected or confined in the common receptacle, and all the same disorders will follow which we before mentioned in the glands thus affected, and the testicle will be thence distended into a hard indolent tumour, that is, it will become scirrhus. There are numerous instances in practice which confirm what we have been now saying, and show that the cure in these parts is extremely difficult as well as in other scirrhus glands, since the testicle, being thus indurated, may easily degenerate into a cancer. But the same disorder likewise takes place in the
other

other viscera. For in the liver the bile is separated from the blood of the vena portæ, which is dispersed in very small branches throughout the whole substance of the liver; and the hepatic bile, being from thence received into the large hepatic duct, is conveyed thro' that towards the intestines. If now the hepatic duct is obstructed, or if the smaller branches, which open into that duct, and discharge the bile separated from the blood, are by any cause compressed or stopped up by the stagnating and congealing or inspissation of the humour, the whole liver, or at least some part, may be distended into a scirrhus tumour; and the production of this disease in the liver is much favoured by the slower motion of the blood of the vena portæ, (since, after passing through the veins, it is again propelled through the narrow extremities of converging vessels), and thence also the secreted humour may easily degenerate into a viscid and impervious state. So that although, according to some anatomists, we do not admit any such follicles collecting the juices secreted from the arteries, seated in those glands which we call conglomerate, as for example in the parotids and others, which discharge their juices by small emissaries into a common excretory duct, but have not intermediate follicles or cells interposed betwixt the secretory branches derived from the arteries, but convey their secreted juices directly into the excretory duct; yet a scirrhus also arises from the same causes in those vascular glands; namely, when the juice secreted from the arterial blood is coagulated or inspissated, so as to obstruct the common excretory duct, or those small secretory branches which convey the juice into the common receptacle. For the greatest difficulty in the cure of a scirrhus, seated in glands properly so called, consists principally in the matter confined in those follicles being lodged without the course of the circulation, so that the impulse of the arterial juices propelled by the force of the heart and vessels cannot act immediately upon those parts. But as the parotid gland is composed of very small arteries convoluted into a bunch, it may be much questioned, whether the im-

petus

petus of the arterial blood can be ever extended to those ultimate cells or vessels in which the humours are inspissated, so as to remove the obstruction, or to separate those small vessels together with their obstructing humours by suppuration from the other sound vessels with which they cohere: at least it will appear, I believe, from considering these particulars, that there will be the greatest difficulty to remove such an obstruction; as we are taught by those tedious and obstinate indurations of this kind which are formed in the testicles.

It would seem, therefore, that a scirrhus must be more difficult to cure, in proportion as it is seated in more complicated glands: for when those simple follicles are obstructed, which collect and discharge the fat liniment of the external skin, the secreted humour is then accumulated, the follicle distended, and a tumor produced, which from the different consistence of the contained matter receives various denominations, as *atheroma*, *steatoma*, *meliceris*, &c. as we observed before in the commentary on §. 75. and §. 122, n^o 1. For these tumours seem to be properly referred hither, especially when their contained matter is hard, as in a *steatoma*; for then they are comprised under the general definition of a scirrhus, (see §. 392.) But surgeons boldly make an incision into those encysted tumors, and press out the contained matter; and at last they also consume the cyst or containing follicle by strong suppurative or corroding medicines, and this with very good success. For these tumours seldom degenerate into the malignity of a cancer, even though they seem by external appearance to resemble a malignant scirrhus. I saw a remarkable instance of this in our city of Leyden. A man of sixty years of age had a hard tumour for several years, which gradually increased, and at length equalled the size of one's fist, seated in the lower part of the left side of his face, near the angle of the lower jaw; it adhered to the skin with a broad basis, but so moveable, that it might be easily elevated, together with the skin, without growing to any of the subjacent parts. This tumour began by de-

grees to be more protuberant, the skin looked red, and appeared almost livid in the point of the tumour; and first an itching, and then a pain followed in the distended skin; but although the patient's family was much alarmed, yet he would not suffer any thing to be applied to the tumour, which broke spontaneously in its point: by this means a granulated hard matter was discharged, and all the tumor subsided; so that there were scarce any remaining signs of it, and he survived afterwards for many years to a great age. But in compound glands, if they are rendered scirrhus, the inspissated juices are not confined in one common cavity, but in several distinct vessels or cells, from whence again the cure becomes much more difficult.

Besides this, if a compound gland has been rendered scirrhus, there is a great deal of difference as to what vessels the obstructed matter is confined in. For in these glands there are vessels which carry arterial blood, from whence is separated the juice peculiar to the gland by its particular fabric; there are also vessels which separate that juice from the blood brought thither; and there are other vessels for the reception of the secreted juice, and still others for the excretion or discharge of it. If now the different vessels are obstructed, the impulse of the vital humours will violently urge against the obstructions, so as to make a separation of the obstructed ends from the pervious vessels by suppuration. And perhaps this is the case, when the parotid glands, being tumefied after many diseases, terminate in a mild suppuration. But when the obstruction is seated in the secretory vessels, it is very evident, that the circulating juices cannot act with so great a force against the obstructions: and when the concremented humour stagnates and obstructs the vessels which receive and collect the secreted juice, as it is seated without the course of the circulation, it will resist the efficacy of the most powerful medicines. But when the disorder is seated in the excretory ducts of the gland, the obstruction is then equally stubborn, unless the situation of the gland is such as will conveniently admit the application of attenuating and resolving remedies to act upon

upon the concreted humours, or to remove the cause which obstructed or compressed the final orifice of the excretory duct of the gland so as to hinder the discharge of its proper juice. Thus, for example, if the excretory duct of the parotid gland should be obstructed and distended with a viscid humour, the whole fabric of that gland will be converted into a scirrhus: but the situation of that duct gives hopes, that the disorder, being as yet incipient, may be removed by fomentations and frictions; and this more especially when the obstructing cause is seated about the opening of the excretory duct in the mouth, or when the same duct is compressed by any adjacent tumour. This thing is confirmed by what we observe in disorders of the genital parts. For if, from a gonorrhœa, or any other cause, a tumour is formed about that part of the urethra where the seminal vessels and vasa deferentia open, the excretion of the humour secreted by the testicles is impeded, sometimes in both testicles, but more frequently only in one; and after this the vas deferens epididymis begins to swell, and at length even the proper substance of the testicle itself is very much enlarged. We then always observe, that first the epididymis begins to swell, and often becomes considerably hard: after that, the testicle itself begins to be distended to a larger bulk, only it appears much softer to the touch than the epididymis: and in this case we frequently remove the disorder without much difficulty; because the seat of the obstruction is not in the substance of the testicle itself, but only about the end of the excretory duct opening into the urethra. For so soon as that tumour in the urethra is diminished, that of the epididymis subsides also by degrees, and by the use of gentle frictions returns to its former bulk and softness, while the whole tumour of the testicle itself also subsides in a little time. But when the *substance* of the testicle is converted into a hard tumour, no defect being first observed in the epididymis, the disorder is then much more difficult; and such a scirrhus can be very rarely, if ever, resolved. For the disorder is then seated in the smallest secreting

vessels, or in those which contain the secreted humour, so wonderfully and regularly disposed in numerous convolutions, that the impetus of the vital humours, brought by so small an artery as the spermatic, can produce very little or no effect towards removing the obstruction; nor can much be expected from the use of external remedies, since this most intricate fabric of the testicle is confined in and defended with so many coverings.

Since therefore a scirrhus may arise from a coagulation, inspissation, or drying up of the glandular juice, it is evident, that this disorder will arise most frequently in those parts of the body where the glandular fabric separates a very viscid humour, or which at least soon becomes viscid if it is not so immediately after its first separation. The whole internal mouth, especially the fauces, œsophagus, wind-pipe, bronchia of the lungs, &c. have mucous cells of this nature, in which a thick mucus is deposited to lubricate and defend these parts; and therefore it is no wonder that a scirrhus is there frequently produced.

Next are enumerated those parts of the body in which a scirrhus is more frequently observed.

In the eyes.] The sebaceous glands, seated in the margins of the eye-lids, prepare an unctuous liniment to lubricate the eye-lids, and defend them from mutual attrition against each other; and these emissaries, if obstructed, may swell, and form scirrhus tumours very frequently observed. Also the *glandula innominata*, here seated, is obnoxious to the same disorder. That caruncle, likewise, which is seated in the larger canthus of the eye, does sometimes become scirrhus, and enlarges itself to a considerable bulk. Hildanus^a happily removed such a scirrhus formed in the greater canthus of the left eye, equal to the size of a chestnut; and in three weeks time he completed the cure, without at all injuring the sight. The same author relates^b a much more terrible case of this nature, in which a large, hard, scirrhus tumour, of a livid colour, and beginning to be cancerous, protuberated out of the eye.

^a Observat. Chirurg. cent. 1. obs. 2. p. 13. ^b Ibid. obs. 1. p. 2.

eye-lids, equal to the size of a goose-egg, the removal of which was attended with a very profuse hæmorrhage; but yet the same author very dextrously cut away this whole tumour, together with the entire bulb of the eye out of its orbit, by incision, in a manner which he there describes, and by that means cured the honourable person of his calamitous disorder.

Nose.] The mucous membrane investing the cavity of the nose is beset with numerous small glandular corpuscles, represented by Ruysch^c. But since the liquor separated by these glands is very easily inspissated, there is therefore frequent occasion given for a scirrhus to be formed in this membrane. Even Hippocrates seems to have described scirrhusities here seated, where he treats of polypuses, of which he distinguishes five kinds. But in speaking on the second kind, he says, *That the nose is filled with flesh which feels hard to the touch*^d; and therefore he orders it to be burnt away by the actual cautery. But the fourth species of the polypus he describes thus: *Internally there is a certain hard substance produced by some cause about the cartilage of the nose, and which seems to be flesh; but if you touch it, the sound is like that of a stone*^e. This he also orders to be cured by cauterization, after making an incision through the nose by the scalpel. But in the fifth kind of the polypus he affirms, *In the extreme part of the cartilage they arise obliquely, like small cancers*^f; and these he would also have cauterized.

In the mouth.] It is well known at this day, that almost all the internal parts of the mouth are furnished with mucous cryptæ. The bones of the palate are invested with a callous or tough membrane; and the uvula, tonsils, moveable palate, with the mucous membrane contained betwixt the convolutions of the os turbinatum, have great numbers of these mucous follicles

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^c Epist. ix. tab. 9. fig. 7.

^d Nasus carnis impletur, et attacta caro dura apparet. *De Morbis, lib. ii. cap. 11. Charter. Tom. VII. p. 563.*

^e Intus circa cartilaginem durum quid aliqua ex causa nascitur, et videtur esse caro; si vero attigeris, sonat velut lapis. *Ibid.*

^f In cartilaginis summa parte ex obliquo velut parvos cancri exoriri. *Ibid.*

discharging great plenty of mucus by their open mouths. The back part of the fauces has also numerous mucous lacunæ of the like nature, which appear like ulcufcules, and are frequently mistaken for such by the unskilful. It is therefore no wonder that scirrhus tumours are so frequently observed in these parts. I have sometimes seen the tonsils indurated or scirrhus after an inflammation of them badly treated. The uvula has also grown into an unequal, hard, or scirrhus and livid tumour, so as to fill up the whole cavity of the mouth, and almost come into contact with the foremost teeth, as Hildanus^s has observed. The same author has^h also observed a hard unequal tumour about the root of the uvula, equal to the size of a hen's egg; whence the respiration was obstructed, and the deglutition of the food, but more especially of the drink, very much impeded.

In the breasts.] Although Ruyschⁱ denies the breasts to be glandular, yet such is their fabric, and such the nature of the milk which they separate from the blood, that scirrhusities are very easily formed in the breasts, the truth of which we are convinced of from daily experience. For the lactiferous tubes arising from the arteries, join together into larger branches, without the interposition of any follicles; and at length they make large lactiferous ducts, which being again contracted or diminished in their diameter, at last terminate in the very small orifices of the nipple. But since the milk collected in the breasts, and distending the lactiferous vessels, may return again into those vessels from whence it was derived, therefore the most turgid or distended breasts are sometimes soon emptied and collapsed without so much as a drop of milk being evacuated by the nipple; whence it is evident that the lactiferous tubes are continuous with the arteries themselves, and that there are no follicles interposed betwixt them. But milk being of its own nature very apt to coagulate, will by stagnating in the dilated lactiferous vessels, separate into whey, and a thicker crassamentum or colostrum;

^s Observ. Chirurg. cent. 1. obs. 19. p. 93.

^h Ibid. obs. 20.

ⁱ Epist. Prob. xv. p. 10. &c. et alibi pluribus in locis.

strum; this thinner serous part will escape through the small ducts of the nipple, or else easily return back again into the blood; whence the thick crassamentum, being deprived of its fluid serum, will stagnate or become impervious in the lactiferous vessels, and drying by degrees it often at length forms an almost irresolvable scirrhus. And as in glands properly so called, a scirrhus so frequently proves inflexible to the best remedies, only because the impulse or efficacy of the vital humours has little or no influence upon the concentered juice confined in the cavity of the gland, therefore the same thing will likewise take place in the breasts. For the larger lactiferous ducts will correspond to the cells or cavernous parts of the glands collecting the secreted humour; while their narrow extremities opening through the nipple, have the same uses with the emissaries of the small glands discharging the humour collected in their cavity. The reason is therefore evident why a scirrhus may be formed in the breast, notwithstanding it is not properly glandular.

In the arm-pits and groins.] It was said before, in the commentaries on §. 416, that the glands here situated are the best adapted to receive those humours which separate critically from the whole mass of blood; and that therefore nature deposits a certain matter in these parts for the welfare of the whole machine, sometimes even in health as well as in diseases, which matter would perhaps have been more prejudicial in some other part. Hence tumours often arise very suddenly in these glands, and sometimes prove very stubborn and inflexible, either from the nature of the impacted matter, or from the very intricate texture of the vascular compages, which occasions the impulse of the arterial fluids to act with less efficacy upon the obstructed parts. When an inveterate scirrhus is seated in the breasts, there is generally at the same time a tumour and induration of the subaxillary glands. And it is well known to all, that the inguinal glands are sometimes changed, by a venereal taint, into scirrhi very difficult to cure.

But scirrhi are not only observed in the external parts
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of the body, but they are likewise very often seated internally, and give rise to the most obstinate chronical diseases.

Pancreas, mesentery.] There are many practical observations which demonstrate these parts to have been found scirrhus; but it may be sufficient for our purpose to mention a few instances. A country woman, aged one and fifty years, the mother of many children, lived in good health, till, for five years past, her menses being suddenly suppressed, she began to be disordered, was troubled with frequent vomitings, together with a tumour of the abdomen sensibly increasing, till at length, filling the whole right hypochondrium, it might easily be felt by the hands and moved towards the left side; but at length, after intolerable pains, she expired. After opening the body, among other disorders, all the glands of the mesentery were found scirrhus; and the tumour which was sensible to the touch in the right hypochondrium was found to be the pancreas scirrhus and distended. Even the valve of the pylorus appeared scirrhus, and the internal surface of the stomach was beset on all sides with little white hard glands^h. The whole pancreas and mesentery were observed scirrhus, and distended to an immense bulk, by Pareyⁱ, in opening the dead body of a woman aged sixty years; and he affirms in the same place, that, in the dead bodies of those who have been afflicted with scrophulous disorders, he has observed the glands of the mesentery tumefied in different degrees, so that some of them have been as large as one's fist; and that some had been found full of a chalky matter, while others were purulent. In the dead body of a dropsical woman most of these glands were found scirrhus, and ten or twelve of them were as hard as wood, and as large as one's fist^k.

In the uterus.] That the uterus is apt to turn scirrhus, has been long ago observed by Hippocrates; and in that place only (at least I do not remember to have met

^h Miscellanea Curiosa, dec. 2. ann. 6. p. 271.

ⁱ Livre vii. chap. 21. p. 175.

^k De la Motte Traite complet de Chirurgie, Tom. II. p. 160.

met with the word elsewhere) he uses this word: for he says, *If the uterus should be affected with a scirrhus, then the menses are suppressed; the os tincæ is closed; nor is it apt for conception, but is in a manner like a foreign body; and if you touch it, it immediately seems like a stone*¹, &c. A scirrhus of the uterus is also described by Ægineta^m. And even Hippocrates, in another place, writes, that a cancer of the uterus is to be feared from a schirrhous: *When the uterus in women becomes indurated, and protuberates at the pudenda, and feels hard in the groins, with a heat in the pudenda, it begins to turn cancerous*ⁿ. It is also evident from more modern observations, that such a disorder has been sometimes found in this part of the body. In the dead body of a woman who was a long time troubled with a distension and hardness of the abdomen, Parey^o found the uterus as large as the head of an adult person; and after taking it out of the body, and attempting to divide it before several physicians and surgeons then present, he found its whole substance so hard and scirrhus, that he could scarce cut through it with a sharp scalpel. The sides of the uterus, when divided, appeared more than equal in thickness to three fingers breadth. In the cavity of this uterus was found a hard scirrhus body, equal to the size of two fists, and adhering to the sides of the uterus only in some parts; and in the mass of this atheromatous tumour, were found cartilages and even bones. And in the middle of the neck of the uterus, a scirrhus tumour of the like nature was found, exceeding the size of a hen's egg. But the uterus itself, with its contents, weighed above nine pounds. There are more observations of the like nature

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¹ Si uteri scirrhus affecti fuerint (ὡς αἱ μenses σιρρωσώσι), tum menses occultantur, tum illorum os connivet, neque concipit, et velut aliud quid est. Quod si contigeris, tanquam saxum illic videtur, &c. *De Mulierum Morbis*, lib. ii. cap. 38. *Charter. Tom. VII. p. 821.*

^m Lib. iii. cap. 68 p. 54.

ⁿ Quum mulieri uteri duci evadant, et ad pudenda promineant, et inguina indurentur, et adior in pudendis insit, canescere incipit. *De Natura Mulier. lib. ii. cap. 28. Charter. Tom. VII. p. 692. et de Morbis Mulier. lib. ii. cap. 41. ibid. p. 823.*

^o Liv. xxiv. cap. 41. p. 616.

ture in Hildanus ^p, which further confirm what we have advanced.

But although a scirrhus is more frequently seated in those parts of the body, enumerated in this aphorism, yet it is likewise sometimes found in the other viscera. Thus we read in several of the writers of observations, that the liver has been found scirrhus, either throughout or in part. Aretæus ^a records, a scirrhus of the spleen is a very frequent and stubborn disorder. Scirrhusities of the stomach and intestines have been remarked in the instances lately mentioned, and are to be found in many of the writers of observations. We even read of the whole urinary bladder being scirrhus, its membranes being equal in thickness to a quarter of an inch ^r.

§. 485. **H**ENCE, therefore, a scirrhus may be produced either by an inflammation (392); a stagnation, coagulation, and induration of the milk into a substance like cheese; a contusion (324); violent attrition; from an anthrax, a bubo, or an ulcer closed before its due time; or from an atrabiliary matter of the blood or bile, and more especially when the menstrual or hæmorrhoidal flux has ceased from its usual discharge; as also from a matter which becomes like stone, rough, thick, or chalky; to which add, a melancholy or sorrowful life, a coarse diet, and an hereditary weakness or disposition to these disorders.

In this aphorism are enumerated the principal causes from whence a scirrhus may arise.

Inflammation.] It was said before, in the commentary on §. 392, that an inflammation of a glandular part sometimes terminated in a scirrhus; and that then the extremities of the obstructed vessels did not separate from the adjacent sound parts, but that they and

^p Observ. Chirurg. cent. 1. cap. 65, 66, 67. p. 51. ^a De Causis et Sig. Morb. Diut. lib. 1. cap. 14. p. 43. ^r Abridgment of the Phil. Transact. Vol. III. p. 147.

and their impervious juices continued in their diseased state, so as sometimes to acquire an incurable disposition, inflexible to all the endeavours of art, so that it must either remain in that state as long as the patient lives, or be removed by the knife or by fire. The ancient physicians have very well remarked this origin of a scirrhus from an inflammation. Thus Aretæus: *If the liver is not suppurated by a phlegmon, it is not improbable that the hard tumour will in process of time be changed into a scirrhus* ^a. And Ægineta, treating on a scirrhus of the uterus, has the following sentence: *Sometimes the uterus becomes suddenly scirrhus without any manifest cause: but it generally follows from a preceding phlegmon, which has neither been dispersed, nor converted into an abscess* ^b. But inflammations which have been badly cured, leave scirrhus tumours not only in the glands, but also in other parts of the body; as Galen observes, where he treats of the cure of an erysipelas, (see the passage cited in the commentaries on §. 390.) For after saying that an erysipelas requires more cooling than a phlegmon, he observes, that, by an unskilful use of coolers, the skin becomes livid, and even black, more especially in old people; so that some of the parts which have been thus cooled, cannot be perfectly cured even by the use of discutient medicines, but leave a sort of scirrhus tumour behind. And perhaps a scirrhus arises very often in this manner after inflammatory diseases in parts which are not glandular, when, by frequent bleeding, the vital powers are so much weakened, that the impulse of the vital humours is not sufficient to remove the obstructing particles impacted into the narrow extremities of the converging vessels, nor yet is it able to separate them by a mild suppuration. Hence perhaps it is that we so often find the lungs adhering to the pleura, and in part rendered scirrhus after a pleurisy; for the membranous

^a Si a phlegmone jecur non suppuratur, non est absurdum, tumorem autem temporis progressu in scirrhum mutari. *De Caus. et Sign. Morbor. Diuturn. Lib. i. cap. 13. p. 42.*

^b Scirrhescit uterus, aliquando repente, sine causa evidenti: plerumque vero a phlegmone progressa, quæ nec soluta, nec in abscessum conversa fuit. *Lib. iii. cap. 68. p. 54.*

branous parts have been observed to degenerate surprisingly in this manner, after violent inflammations in them not well cured: and this we shall explain hereafter in the history of a Pleurisy; where it will appear also, that the pericardium is sometimes inflamed, and even more frequently than is commonly imagined. Even this thin membranous capsule of the heart has been found wonderfully thickened and indurated in dead bodies, after long disorders in the breast. Thus in the body of a sailor, who, being troubled with a violent asthma and cough, at last perished by a dropsy of the abdomen, scrotum, legs, and thighs; among other injuries the pericardium was found an inch thick, and firmly adhering to the heart, being almost as hard as a cartilage, so that it could scarcely be divided by a knife ^c. For although the pericardium has been so altered by diseases as to cause Malpighi ^d and Santorini ^e imagine they saw glands, yet in the case just mentioned the membranous substance itself seems to have thus degenerated, since there were no dilated follicles found indurated, but the whole pericardium appeared to be converted into cartilage.

Milk stagnant, &c.] See what has been said upon this subject in the commentaries on the preceding aphorism. More especially a scirrhus frequently arises from this cause in the breasts of women who give suck, and who, fearing a suppuration, expose their inflamed breasts to the heat of actual fire, or foment them with hot spirit of wine. The tumour is indeed by that means frequently lessened either by a dissipation or a discharge of the more thin and serous parts of the milk stagnating in the lactiferous ducts through the nipple; but then there is frequently left behind an irresolvable scirrhus, not curable by any art.

Contusion.] See what has been said in the commentary on §. 324.

Violent attrition.] For from thence a violent inflammation and all its consequences may follow. In the

^c Acta Physico-Medica, &c. Tom. II. obs. 20. p. 48. ^d In Epistola ad Societ. Londin. de Structura Glandul. Conglobat. &c. p. 7. edit. Londin. ^e Observat. Anatom. p. 142.

the common prostitutes we frequently meet with scirrhus tumours or condylomata in the vagina, arising from the too great attrition; but in those who have been addicted to a more filthy lechery, the like disorders appear, while

————— *podice lævi*

Cæduntur tumidæ, medice ridente, mariscæ f.

Anthrax.] What this is, has been explained in the commentaries on §. 416. namely, when after a sudden and violent inflammation of the skin and subjacent panniculus adiposus, part of them is converted into a dry and hard eschar; the cure of which consists in separating the eschar by suppuration from the living parts. But if this cannot be obtained, a scirrhus tumour will remain after the inflammation of the adjacent parts is removed; more especially when the disorder is seated in a glandular part.

Bubo.] This term, in general, signifies a tumour of the glands, arising even in different parts of the body, as we observed in the commentary on §. 416; but more especially this name is given to a tumour of the inguinal glands. But very frequently these tumours arise from venereal contagion; and often continue a long time inflexible, even to the best remedies.

An ulcer healed up before its time.] It is frequently observed, that when a phlegmon is converted into an abscess, the middle of the part is soft and ripe, though the whole circumference of the tumour is as yet hard, (see the commentary to §. 402, no 2.) and therefore such an abscess ought not to be presently opened. But it sometimes happens, that the tense integuments, being macerated by cataplasms applied to the pointing part of the abscess, break of themselves, and give a discharge to the contained matter, while, at the same time, part of the tumour is left crude and hard. If then such an ulcer is not kept open, and the parts dressed with suppurative and deterging medicines, a scirrhus hardness frequently remains for a long time; which yet is usually dissipated by degrees, when not seated in glandular parts. But when such a hardness

is left in the breasts after a suppuration badly treated, it frequently occasions an irresolvable scirrhus. But a scirrhus arises from no cause more frequently than from venereal buboes tending to suppuration, and opened before they are brought to maturity; or else from a too soon healing up of the ulcer left after such a bubo, when the surgeon is tired with the tediousness of their cure: for in these cases something of a scirrhus is almost constantly left remaining.

An atrabiliary matter of the blood, or of the bile.] Whenever the most fluid part of the blood is destroyed, either by violent exercise of the body, or long-continued passions or application of the mind, then the remaining part of the blood appears blacker than usual, and almost as tenacious as pitch; so that, from the oily and earthy parts of the blood combined together, an impervious tenacity is produced in the blood, by which it passes with more difficulty through the smallest extremities of the converging vessels: this tenacious matter, so extremely apt to form obstructions, is termed *atra-bilis*. But when the *bile*, properly so called, stagnates in its receptacle, it may become surprisingly tenacious, and very often degenerates into calculous concretions: And such a thick matter, formed by the stagnant and inspissated bile, is also termed *atra-bilis*; but is much more acrimonious, and more easily inclined to putrefaction, than the former arising from the crassamentum of the blood. This last species of the disorder may disturb the whole office or elaboratory of the bile, and obstruct the parts in which it was contained; and afterwards putrefying, it may produce the very worst consequences. But the former species of the *atra-bilis* seems to be most apt to produce scirrhusities; since the blood, infected with such a lentor or tenacity, may easily stagnate in the most intricate or vascular texture of the glands. Practical observations teach us, that scirrhusities are most frequently found in those who are naturally inclined to an atrabiliary habit of body; the signs of which are enumerated at §. 896 of the Institutions of our celebrated professor Boerhaave. The ancient physicians have al-

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most constantly accused atra-bilis as the cause of scirrhi and cancers: and even Galen⁸ acknowledges only this origin of a cancer, when the atrabiliary humour is collected in the body, and not evacuated either by the piles or varices, nor yet propelled to the skin, nor deposited upon other parts of the body. They were confirmed in this opinion, by observing the veins in the parts thus affected full of thick and black blood; but why this happens, will be declared hereafter in the history of a Cancer at §. 497. The great similitude betwixt the effects of scirrhotities and the atra-bilis, proves, that the one frequently proceeds from the other. For the tenacious and pitch-like atrabiliary matter generally fills and obstructs the small vessels of the abdominal viscera, so as to produce the most stubborn chronical disorders. But when from any cause that stagnating humour begins to corrupt and dissolve, it rages with incredible malignity, (and is then by the ancient physicians usually termed *turgid* or *moving atra-bilis*), so as to excite the most acute fevers, which prove fatal in a very little time, even in the coldest habits of body; and from thence follow malignant dysenteries, erosions of the viscera, faintings, and even sudden death. But a scirrhus may also remain for a long time in several parts of the body without injury, unless the adjacent vessels are much compressed; but if the old scirrhus matter, either naturally or by an imprudent treatment, is excited into motion, it soon degenerates into a horrid cancer.

More especially when the usual discharge of the menses is suppressed.] The greatest changes in the habit of the female sex is produced at that time when the menses begin first to appear; as also at that time when they begin to disappear in elderly women, or such as are past child-bearing. For the observations of almost all physicians teach, that about this time scirrhus tumours often arise in the uterus and ovaries from an infarction of their vessels. But so great is the consent between the uterus and breasts, that so soon as the discharge of the menstruous blood is suppressed in the for-

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mer, the latter begin to swell, as is evident in women with child; and also in lying-in-women, whose breasts are distended with milk when the lochial discharge ceases or is much diminished: and therefore it will be no wonder, that, upon a cessation of the usual menstrual flux, the breasts should be affected, their vessels distended, and scirrhus tumours thence formed. It is also frequently observed at that time, that scirrhi arising from other causes increase in bulk, and are then very often changed into cancers. These things have been well observed by Hippocrates, who says, *When the menses are suppressed in the uterus, they are transmitted to the breasts*^h. And after enumerating the several symptoms by which women, being deceived, believe themselves with child, he adds, *And in the breasts there are hard tubercles formed, some of which are large, and others but small; but these do not in the least suppurate, but always become harder, and give rise to latent cancers*ⁱ. Dionis^k concludes from his own observations, that out of twenty women afflicted with cancers, fifteen of them are troubled with the disorder betwixt the forty-fifth and the fiftieth year of their age: and adds, that in his journey thro' most of the cities and provinces of France, he observed many afflicted with this disorder in the monasteries, but always about the forementioned age of life; or if the disorder was found in those of younger years, their usual menstrual discharge was suppressed. Even by a retention or too small a discharge of the menses, tumours are formed in other glandular parts of the body, insomuch that Hollerius^l observes, that he had seen, in one year, more than two hundred girls, who had tumours in their groins, for want of a sufficient discharge of the menstrual blood in the middle of the spring. And in that case, which we mentioned in the

^h Conclusi uteri, menses ad mammas remittunt. *De Morbis Mulier. lib. ii. cap. 20. Charter. Tom. VII. p. 807, 808.*

ⁱ Et in mammis tubercula dura oriuntur, quædam quidem majora, quædam vero minorâ. Hæc autem minime suppurant, sed semper duriora sunt, et ex illis occulti cancri nascuntur. *Ibid.*

^k Cours d'Operations de Chirurgie, demonstr. 9. p. 314.

^l Comment. 2, in lib. iii. Coac. Hippocr. p. 346.

the commentaries to the preceding aphorism, the woman, who had hitherto lived in health, was taken ill about the forty-sixth year of her age, when her menses were suddenly suppressed; and afterwards, upon opening the dead body, the mesentery, pancreas, stomach, and pylorus, were found scirrhus. From all which it is sufficiently evident, how much a suppression of the menses may conduce towards the formation of a scirrhus, or towards the increase of one already formed.

Or hæmorrhoidal flux.] As the atrabiliary humour used frequently to be deposited about the abdominal viscera, as will appear hereafter in treating upon the Melancholia, from whence a great many and very surprising disorders follow; therefore nothing seems to be more useful than to discharge the viscid and often pitch-like blood by the hæmorrhoidal vessels, as we frequently observe in men of a melancholy habit; whence Hippocrates^m commends the piles when they happen to melancholy patients. When therefore the atrabiliary matter of the blood, which used to be evacuated by the hæmorrhoidal flux, is retained by a suppression of that flux, it may occasion the most stubborn obstructions in the glands, as was said a little before under the present aphorism.

A matter like stone, rough and thick, or chalky.] It would be scarce credible, if it was not proved by numberless instances, that a matter is lodged even in the most thin and limpid humours of our bodies, from whence very hard stones may be formed. The thin and limpid urine secreted from the blood by the smallest renal tubes, very frequently give rise to calculous concretions, not only when it is collected and stagnates in the pelvis and ureters of the kidneys, but also in the kidneys themselves, which have sometimes been found stony throughout. I have seen many renal calculi discharged with protuberances, which seemed to correspond and to have been lodged in the renal ducts, while the remaining part of their surface has appeared smooth. I have seen stones extracted from the sub-

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lingual

lingual glands. Stones have been found in the cavity of the abdomen itself, which is moistened only with a thin dew; as well as in the surface of the brain, and almost in every other part of the body, as we shall hereafter explain more at large in the history of calculi. If, therefore, the like concretions are formed in glandular parts, they produce the most stubborn scirrhi. But we may observe different degrees of hardness in the stones formed in the parts of the human body: for sometimes they are extremely hard, as we more especially observe in stones of the bladder; sometimes they are more soft and friable, as those more especially are which we find in the gall-bladder; and sometimes they are also white and friable, so as nearly to resemble mortar, as I have seen spit up from the lungs: and it appeared from the observations of Parey, mentioned in the commentary to the preceding aphorism, that scirrhus glands of the mesentery have been found turgid with a chalky matter.

A melancholy or sorrowful life.] We shall hereafter explain, in the commentary on §. 1090, how surprisingly this is to be observed in melancholy diseases; namely, from the predominating atra-bilis in the blood, deposited more especially about the abdominal viscera, and exciting an insuperable and astonishing anguish and grief, which often occasions these patients to lay violent hands upon themselves. But violent passions of the mind, and more especially grief, will produce the same kind of atrabiliary matter in the blood, and deposit or fix it in the vessels of the abdominal viscera. Since therefore a sorrowful life may generate this atrabiliary matter, it is evident from what has been said, that the same may also give rise to a scirrhus.

Coarse diet.] Among the causes of melancholy enumerated at §. 1093, are reckoned austere, hard, earthy, and dry aliments, taken for a constancy; and more especially if the body is at the same time indolent and inactive, or not addicted to exercise: and from hence men of letters are so frequently troubled with obstinate obstructions in their abdominal viscera, when they feed too much upon smoky-dried flesh and
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fish, or which have been salted or dried in the air, in the mean time using great application of mind without the least exercise of body: Such frequently find to their great damage, that these hard gross aliments leave their less resolvable parts stagnating in the abdominal viscera; but the laxative pot-herbs, such as lettuce, endive, succory, &c. are serviceable for the bowels of studious people, or such as lead sedentary lives, more especially when assisted with broths of the flesh of young animals, &c. When the children of poor people feed upon crude farinaceous and unfermented aliments, the abdomen is usually distended into a tumour by an infarction of their tender viscera with an almost irresolvable matter; and the children of country people are also afflicted with the like disorders, from their greedily devouring unripe austere fruits.

An hereditary disposition.] It appears from many instances, that consumptions, epilepsies, the gout, &c. pass from parents to their children; and the same is also true of many other disorders. But such hereditary diseases, if not wholly incurable, are reckoned by all physicians to be at least extremely difficult of cure. The celebrated Boerhaave used to tell his audience, that he knew a certain family, in which all the children at a particular age were troubled with the jaundice; and that at length the disorder, yielding to no remedies, destroyed them with a dropsy. Upon opening the dead bodies, (which was readily granted to the physicians, that they might better discover and afterwards prevent or cure this fatal disorder in their family), the liver was always found scirrhus.

§. 486. **T**HE effects or consequences of a scirrhus already formed, are, To occupy the adjacent parts by increasing in bulk, so as to oppress and even compress them, and injure the functions both of the scirrhus and adjacent parts; from whence follow inflammations, suppurations, gangrenes, palsies, wastings, mortifications, barrenness, difficult labours, the iliac passion,

sion, and many of the like disorders, which may be easily deduced from the compression and nature or office of the part injured.

A scirrhus part increases in bulk; which cannot happen, unless the vessels of the adjacent parts are obstructed or compressed, which they sometimes are entirely: and therefore scirrhus tumours are enumerated among those causes which produce obstructions by compressing the vessels externally, (see §. 112, no 1.). The effects therefore of a scirrhus may be very different and almost innumerable, according to the particular nature of the scirrhus part, and the different offices of the parts adjacent, which are compressed by the growing scirrhus. Thus a scirrhus, arising from an external cause, in the breasts of a person of a good habit, very often continues even to old age, without giving any uneasiness: Whereas, when the same disorder is seated in the œsophagus or adjacent parts, which, being tumefied, diminish or compress the cavity of that membranous tube; after tormenting the patient in the most severe manner for the space of several months, obstructing the passage of every thing into the stomach that is endeavoured to be swallowed, it at last brings on inevitable death. It is therefore sufficient here for us to point out the general springs from whence the effects of a scirrhus already formed may be deduced: but the knowledge of every particular symptom or disorder which follows in the human body from a scirrhus as from its cause, will depend on being acquainted with the functions themselves injured in the affected parts. But some of the principal of these are enumerated in the present aphorism.

[Inflammations, suppurations, gangrenes, and mortifications.] In §. 375, where we treated of the causes of inflammation, it was affirmed, that all the causes of obstructions might be likewise the causes of inflammations: but, as we said before, a scirrhus is enumerated among those causes of obstructions which diminish the capacity of the vessels by an external compressure; and from hence it appears how a scirrhus
may

may be the cause of inflammation and its consequences now mentioned. An inflammation, therefore, being formed, all its consequences may evidently take place; namely, a suppuration, gangrene, and sphacelus. But it is to be observed, that a suppuration can never take place in a true and confirmed scirrhus, but only in the circumjacent parts compressed by the scirrhus tumour. And from the observations of Hildanus, given in the commentary on §. 422, n^o 2. where a gangrene was formed in each leg from a compressure of the vena cava by a scirrhus tumour in that part where it divides into the two iliacal branches, it appeared that the gangrene was followed with a mortification ascending up to the knees, which destroyed the patient.

Palsies.] In order to move the voluntary muscles, a free commerce betwixt the brain and the muscles, by means of the nerves, is necessary; if therefore the nerve which leads to a muscle is compressed in any part of its course from the brain by a scirrhus tumour, that muscle will be rendered paralytic. If now a large trunk of nerves, leading to some considerable part of the body, is compressed by such a cause, a perfect palsy will follow in that member. When the subaxillary glands become scirrhus and tumefied, so as to compress strongly the adjacent nervous trunks, it is very evident that from thence a palsy of the arm may arise. Thus I observed, in a woman of sixty years old, who had her whole right breast scirrhus, that at length the right subaxillary glands became also much swelled and indurated; from whence first arose a great pain throughout the whole right arm, and then followed a stupidity and an incipient palsy: and as at the same time the glands in the right side of the neck were much swelled and indurated, the patient was subject to frequent swoonings, perhaps from a compressure of the par vagum and intercostal nerves on the same side.

Wastings.] It was said before, in the commentary on §. 161, that if a large artery was so entirely divided, that afterwards no blood could be derived into the subjacent parts, then all those parts which received their vital blood from that artery must necessarily
 mortify,

mortify, as being destitute of the vital circulation: And we also observed in the same place, that this mortification arose two ways; either from the corrupting of the stagnating humours no longer propelled by the motion of the arterial blood, whence a putrid and flow gangrene; or else the humours left in the subjacent parts were pressed into the adjacent veins by the natural contraction of the vessels, and that by the pressure of the adjacent muscles in action those humours were returned back to the heart: but the vessels being thus deprived of all their juices, will collapse and grow together, so as greatly to diminish the bulk of the part; which at length becomes dried up like a mummy, as we proved by a wonderful instance in the commentary to the aphorism above cited. Now it is evident, that the same evils must arise, if a scirrhus shall by its bulk so compress an artery leading to any part of the body as to impede the passage of the blood which gives life to that part.

Sterility or barrenness.] Sterility in either sex may arise from a scirrhoty or induration in the organs destined to generation, whence their functions are either depraved or abolished; as for instance, the testicles may become scirrhus in men, as we are assured by innumerable instances. But since there are several necessary circumstances required in women, that they may be capable not only of receiving the first rudiments of the incipient animal, but also that they may be able to retain and nourish the same to its proper time of perfect maturity; it is from thence evident, that the causes of sterility are much more frequent in the female sex. In fat women, the large omentum compresses the uterus in such a manner, that they are not capable of receiving the semen masculinum, as Hippocrates^a observes. If the os uteri should be scirrhus, as also its neck, as may be known by passing up the finger, the woman will be barren unless cured of that disorder. But also the opening of dead bodies demonstrates that scirrhoties concealed in these parts have occasioned barrenness. A woman of sixty years
old,

^a De Natura Muliebri, cap. 19. Charter. Tom. VII. p. 690.

old, who had been married twice but never conceived, was opened by Hildanus^b, that he might discover the cause of her sterility: and he found a scirrhus round the os uteri, which invested the neck of the womb like a ring, and by that means so strictly closed its opening, that it was difficult even to introduce a probe. In another woman, who being taken with an inflammation of the uterus in her first lying in, and remaining ever afterwards barren, he found after death, that a scirrhus, equal to the size of a goose-egg, was placed in such a manner before the os uteri, as totally to exclude the passage of any thing to that organ, and so firmly adhered to the circumjacent parts, that it could not by any means be pulled off^c. I have seen the vagina uteri scirrhus throughout, and so much swelled in every point as to be scarce able to admit a probe. It is also frequently observed in women who have lived sterile, that the uterus begins to turn cancerous about the time when their menses leave them; in which terrible disorder they are afflicted with severe pains, and a profuse discharge of a foul putrid matter, the vessels being rendered varicose, and afterwards eroded. From all which it is sufficiently evident, that a scirrhus is deservedly reckoned among the causes of sterility.

Difficult labour.] In order for the mature foetus to be excluded from the uterus, it is necessary for its orifice and vagina to be capable of a free expansion: but if those parts have been indurated by a scirrhus, or if tumours of the like nature are seated in the circumjacent parts, it is sufficiently evident that from thence the birth may be rendered extremely difficult, and even quite impracticable. But it is also true, that a scirrhus is seldom extended suddenly to so large a size during the time of gestation as greatly to hinder the exclusion of the foetus, if it did not exist before the time of conception: but a scirrhus formed in the uterus or vagina must occasion sterility, and therefore it is enumerated among the causes of barrenness alleged in the preceding observations. But we are taught by many observations, that women have been impregnated

^b Observat. Chirurg. cent. i. obs. 65. p. 51.

^c Ibid. obs. 66.

nated when there was but a very small or scarce any aperture, or at most but a very small passage, by which the semen could enter into the cavity of the uterus; whence absolute sterility does not always follow, even though a scirrhus is seated in those parts: but then the birth will be always very difficult. There are many such cases related in the writers of observations, which confirm what has been before advanced; but it will be sufficient for us to relate a few. A woman of thirty-eight years old expired in the midst of her pains in her first lying-in, nor could the foetus be delivered: upon opening the body, the celebrated Littre^d found the neck of the uterus obstructed with a glandular substance, which cohered to the uterus, and was in some parts perforated with small foramina. In a woman of forty years old, at her first lying-in, the dead foetus could not be extracted but with great difficulty, by reason of the too great narrowness or vicinity of the bones of the pelvis. The same woman being impregnated again three months after, was about the time of delivery tormented for the space of two days with severe pains, without any dilatation or opening of the os uteri. The sides of the vagina being dilated by a rough instrument, since a speculum uteri was wanting, a cicatrix appeared where the mouth of the uterus was grown together; and while the surgeon was dividing it with a scalpel, he found it almost as hard as a cartilage, and that he was under a necessity of dividing the whole circumference of the os uteri by many incisions, in order to make any dilatation of it. Thus the dead foetus was extracted by the hand of the surgeon; and the unhappy mother being immediately taken with an acute fever, pleuritic pains, and a difficult respiration, expired in twenty-four hours after delivery^e. Upon opening the body of a woman, who, after enduring the pains of labour for six days, died at last undelivered, Hildanus^f found the uterus lacerated, and the head of the infant lodged in the cavity of the abdomen: but the cause

^d Acad. des Sciences, l'an. 1705. Hist. p. 65, 66. ^e Medical Essays, Vol. III. p. 317, &c. ^f Observat. Chirurg. cent. 1. obs. 67. p. 52.

cause of the evil was a scirrhus almost equal to the size of the infant's head, and by which the exclusion of the foetus was prevented.

Iliac passion.] Any cause which can so far diminish the capacity of the intestinal tube in any part, that its contents cannot press forward by the peristaltic motion towards the anus, may produce this terrible disorder; so that in that case the peristaltic motion being inverted, all the intestinal contents are repelled back towards the stomach, and evacuated by vomit, with extreme anguish, terrible to behold. When this disorder is accompanied with an inflammation, it often proves fatal very suddenly; but when without an inflammation, it afflicts the patient much longer. Now a scirrhus, compressing by its weight, or else entirely stopping up, the cavity of the intestine, will give birth to this disorder, as has often been found. In the dead body of a man, who was for some years continually afflicted with a fixed pain under the region of the liver, and at last expired with a most severe iliac passion, Hildanus^s observed a scirrhus, which was become ulcerated, in the bottom of the intestinum cæcum. The celebrated author of these aphorisms saw a remarkable case confirming what has been said. A hopeful lad of a noble family, having heated himself by skating upon the ice, afterwards went into the chair in which his father was drawn; so that being first heated by that violent exercise, he continued exposed to the cold air for near an hour. Soon after, he felt a pain in his abdomen, and from that time began to be ill. After a few weeks, his bowels were constipated, and at length his stools were almost entirely suppressed. His appetite remained good, but almost every three days he with great anxiety vomited up again all the food which he had taken during the time before. After various remedies had been tried to no purpose, the lad died; and the body was given to be inspected by the physicians, who in consultation entertained different notions concerning the disorder. Boerhaave predicted a latent scirrhus; and therefore recommended only laxative remedies,

and such aliments as afford the least *feces* to be collected in the intestines. The other physicians concluded, and persuaded the child's parents, that the use of vomits was necessary to discharge the foul humours obstructing the passages of the bowels; but by these vomits every thing grew worse. After opening the body, a scirrhus was found compressing the *intestinum ilium* near that part where its extremity is inserted into the colon. Before the obstructed part, the small intestines appeared immensely dilated; and behind the obstruction, they were so much contracted, that they hardly exceeded the size of the *processus vermiformis*.

Besides those disorders enumerated in the preceding paragraph, there are many others of the like nature, which may arise from scirrhus tumours seated in other parts of the body. We read of fixed pains continuing for many years, and arising from a scirrhus of the stomach and pancreas inclining towards a cancerous disposition. A scirrhus of the liver often produces an incurable jaundice, and terminates in a fatal dropsy. The instances before enumerated are sufficient to demonstrate, that many chronical and stubborn disorders owe their origin to scirrhi concealed in the internal parts of the body. It therefore now remains for us to treat concerning the diagnosis and prognosis of a scirrhus.

§. 487. **A** PRESENT scirrhus is known from its causes (484, 485), from its effects (486), and from its appearances (392); with the nature of the part affected (484), and the patient's habit; considered, and compared together.

When a scirrhus is seated in external parts of the body, it may be easily discovered; but it is not so easily known when concealed in some of the internal parts. But some light will be reflected into these obscure causes, from considering attentively the following particulars.

Causes.] Thus, for example, if the *predisposing* causes to generate a scirrhus are, An atrabiliary spirit-
tude.

tude of the blood and humours; a gross, earthy, austere diet, long persisted in, without robust exercises of body; with sorrowful affections of the mind long continued: If, again, the *efficient* causes appear to be, A contusion; an inflammation irresolvable, and not terminating in a suppuration; a suppression of the usual discharges by the menstrual or hæmorrhoidal flux; an hereditary disposition of the patient, &c.: If these causes are found to have preceded, there is just reason to suspect a scirrhus.

Effects.] A scirrhus always injures the functions of the part in which it is seated; and very often it disturbs the action of the circumjacent parts, which are compressed by the increased bulk of the tumour. Hence therefore, if the causes capable of producing a scirrhus, have preceded; and the signs of the injured functions denote that the uses of some parts which they had in a healthy state are either disturbed or totally abolished; while the disorder likewise continues in the same state for a long time, without either increasing or diminishing in any considerable degree; the diagnosis which determines the presence of a scirrhus will be then greatly confirmed. Thus, for example, if an acute or inflammatory disorder of the thorax has preceded, without terminating either by a mild resolution or suppuration, a dyspnœa and dry cough will remain after the cure; and these disorders will increase upon the least exercise of body, or after the eating of a plentiful meal: from whence may be justly concluded, that a scirrhus is formed in the lungs, which, by its bulk or weight compressing the air-vessels, renders the respiration difficult, and by compressing the blood-vessels prevents the blood propelled from the right ventricle of the heart from passing freely through all the narrow extremities of the pulmonary artery; so that when the velocity of the blood is increased by exercise of body, or crude chyle mixed in too large quantities with the venous blood of the right ventricle of the heart, the lungs begin to be oppressed, and the resistance to the right ventricle is increased, which the patient thus oppressed endeavours to remove, even against his inclination,

by increasing the efforts of his respiration. A latent vomica in the lungs, compressing the adjacent parts, will indeed produce the same effects; but then the anxiety will increase in proportion as the matter is increased, until the patient is either suffocated, or else freed by a rupture of the vomica or abscess: To which add, than an hectic fever, which is almost a constant attendant on this last disorder, will likewise sufficiently denote that this is the latent disorder. But when a scirrhus is lodged in this part, every thing continues in the same state for a long time, and the disorder often continues for many years without any increase.

Appearances.] Which, in a scirrhus occupying some external part of the body, are, An indolent tumour, with hardness: but when it is seated internally, these appearances cannot be discovered by the senses; so that in that case the effects or symptoms are the only signs of a scirrhus.

Part affected.] It was said before, in the commentary on §. 484, that a scirrhus was most frequently seated in glandular parts; and more especially when the fluid separated by the gland is of its own nature very apt to concrete or inspissate; as for instance, the milk in the breasts: from whence it was made evident, that a scirrhus might be produced in those glands, even by slight causes.

Patient's habit.] Namely, whether the habit or temperature of the patient be atrabiliary, which, as we observed in the commentary on §. 485, is extremely apt to produce a scirrhus; but the signs of this atrabiliary constitution will be enumerated at large when we come to treat concerning the Melancholia.

§. 488. **F**ROM the same considerations (487), the events or consequences of a scirrhus are prefaged, considering the duration and effects of the disorder (486). A scirrhus is of itself inoffensive; but it frequently becomes malignant or cancerous, by exciting or too much increasing

creasing the motion of the humours in the vessels of its circumference.

In the prognosis is determined whether the cure of a scirrhus will be easy or difficult, after it has been discovered by the diagnosis; in the same manner we can also foresee those disorders which will arise from the injured functions of the circumjacent parts, either immediately affected by the scirrhus which they contain, or by the compressure which it makes. The prognosis is therefore to be deduced from the same springs, from whence the diagnosis was derived. For the cure of a scirrhus, for instance, will be much more difficult, which arises from an atrabiliary spissitude of the blood, than if the same disorder remained after an inflammation. Very different consequences are to be feared, if a scirrhus is seated near large blood-vessels, which it compresses by its bulk; than if that scirrhus lay in the breasts, where it would hardly be offensive unless it degenerated into a cancer. But in a prognosis, attention is especially to be given to the continuance and various effects of the scirrhus. For, as we shall make appear by and by, a recent scirrhus for the most part affords considerable hopes of a cure; whereas, if the disorder has continued for many years, it is totally incurable, unless it can be extirpated. But the effects of scirrhi differ chiefly according to the nature of the parts in which they are seated or which they compress.

But since a scirrhus is an indolent tumour, it will not of its own nature do much damage, unless seated in some part where a compressure of the adjacent vessels or viscera would disturb some principal function of the body. Thus I have known a scirrhus lie dormant, without the least injury, in the breasts, for the space of twenty years and upwards: and it even appears from observations, that they have lain, without much damage, concealed in the internal parts of the body. In a man of sixty years old, who died by a fall from a high place^a, Littre found the whole spleen pe-

^a Academ. des Sciences, l'an 1700. Hist. p. 501.

trified; yet the patient had never complained of any disorder, but always lived healthy and chearful. But the bulk of this scirrhus spleen could not be considerable, since it only weighed an ounce and half; and therefore it could not much compress the adjacent parts by its bulk. Even Hippocrates, treating concerning those who are troubled with disorders of the spleen, has the following passage: *But, in process of time, the disorder in some degenerates into a dropsy, and then they waste away. In some, again, the spleen suppurates; and they are cured by caustic: and in others, the spleen being larger and hard, the disorder becomes inveterate. The disease arises when bile, or phlegm, or both, are deposited in the spleen, in fevers which have been badly treated; and though the disorder is of long standing, yet it is not fatal*^b. But if we consider the nature of a scirrhus, it will be sufficiently evident, that many bad consequences may from thence follow, if the humours are excited into motion through the circumjacent vessels, from whatever cause that increased motion is produced. For, in a scirrhus, the congealed or inspissated matter is collected either in the cells or in the complicated vascular fabric of the gland, which may be therefore looked upon as a dead part: but the vessels filled with this impervious matter, or the follicles distended with the same, have other sound or living vessels dispersed through their membranes; which vessels being compressed or obstructed by the concreted or scirrhus matter, the passage of the humours through them will be rendered more difficult, though still they *will pass* while possessing a placid motion: but when the celerity of the circulation is increased, as for instance by a fever, those vessels, compressed on all sides by the scirrhus, cannot be dilated, though at the same time there is a greater quantity of juices to pass through them. Hence follows an ob-

struction;

^b Progressu vero temporis quibusdam morbus in hydropem degenerat, et contabescunt. Quibusdam vero (lien) suppuratur, et ulsi sani fiunt: quibusdam etiam durus et magnus existens consensescit. Oritur autem morbus, quando ex febribus et mala curatione bilis aut pituita vel utraque in lienem decubuerint; et diuturnus quidem affectus est, non vero lethalis. *De Affectionibus, cap. 5. Charter. Tom. VII. p. 625.*

struction; and, from the force of the increased motion of the humours, an inflammation. For as a considerable heat must follow from the violent attrition in the compressed vessels, §. 382, n° 6. therefore a putrefaction will soon follow in the concreted matter of the scirrhus, (§. 84. n° 4, 5.) with all those disorders of which we shall treat hereafter in the history of a Cancer. Hence therefore the reason is evident, why a scirrhus, inoffensive in its own nature, may become malignant by the increased circulation.

§. 489. **W**HICH increased motion of the circulating humours being often unavoidable, creates continual fears.

For where is the physician who can prevent the motion of the humours from being sometimes increased even in his own body? The passions of the mind, which no one can avoid, and which when raised are scarce governable by the most wise, very often increase the impetus and velocity of the circulation to a great degree (see §. 99, n° 1.) even slight errors in diet may likewise produce the same effect. Exercising the muscles of the body will also be prejudicial in the same manner. But a patient can never be governed so as strictly to avoid all these, since an indolent scirrhus is almost constantly neglected. But although all these circumstances are duly regarded, who can pretend by any art to preserve the patient from being invaded with acute or epidemical diseases, or who can secure him from external injuries, as contusions or the like, by which the hitherto dormant scirrhus may be irritated? Add to these, that those alterations which *naturally* happen to the body, may be sufficient to convert a scirrhus into a cancer; as for instance, when the menstrual flux ceases in women who are past child-bearing, (see §. 495.) It is therefore evident, that while a scirrhus is lodged in any part of the body, there must be extreme apprehensions of its degenerating into a worse disorder; since all those causes which are sufficient to change an indolent scirrhus into a malignant

nant cancer, cannot be avoided by any art or prudence.

§. 490. **H**ENCE therefore, in attempting the cure, it is to be observed,

1. That if the scirrhus is recent, benign, seated in a convenient part, and not yet perfectly indurated, in a patient of a good habit, the cure ought to be attempted by mollifying and resolving, to which conduce more especially acid fumigations, with the power of mercury.

In the treatment of a scirrhus the greatest prudence is necessary, to avoid running into any rash method; since the errors once committed cannot be corrected, and since the worst calamities follow from the perverse treatment of this distemper. Here, therefore, both physicians and surgeons ought always to keep in mind the salutary admonition of Hippocrates, who says, *In those who have occult cancers formed, it is best not to treat them with remedies: for such patients are sooner destroyed by the cure; whereas if they are let alone, they survive a long time*^a. For by the name of *occult cancers* Hippocrates here seems to have understood those malignant and inveterate scirrhi, which are so easily irritated by the application of remedies, that they may soon degenerate into an ulcerated cancer. Before, therefore, any remedy is applied to a scirrhus, it ought to be first diligently inquired whether there are any hopes that it may be resolved; and this may be known if the scirrhus has the following qualities.

Recent.] For then the concreted humours are not yet compacted into an irresolvable mass by the dissipation of their most fluid parts, and it is very rare that the whole substance of the gland is affected in a recent scirrhus, whence there will be a better opportunity of conveying the resolving medicines through the as yet pervious vessels; and the efficacy of those remedies will

^a Quibus occulti cancri oriuntur, illos non curare præstat: curati enim, citius pereunt; non curati vero, multum tempus perdurant. *Aphor.* 38. *sect.* 6. *Charter. Tom.* IX. *p.* 272.

will be greater when they are arrived, inasmuch as the concreted juices are not yet compacted into a stony hardness. If, therefore, a scirrhus should have been lodged for many months in any part of the body, there can be but small hopes of a resolution. Hence Aretæus, in treating on a scirrhus of the spleen, justly pronounces: *Such as are arising ought to be prevented; and those which have but lately begun to be formed, are to be resolved*^b. But he observes in the same place, that it is not very easy to resolve these scirrhi.

Benign.] So long as a scirrhus remains indolent, without being very large or very hard, its integuments not having changed their colour, nor any great heat or itching being as yet perceived either in the scirrhus or its adjacent parts, it is then said to be *benign*. But if the contrary takes place, it is then termed *malignant*, the signs of which we shall enumerate at n^o 3.

Seated in a convenient part.] Namely, so as to be conveniently accessible to the hand, and to admit the application of proper remedies; that, if the benign scirrhus should be unexpectedly irritated by the applied remedies, it may be entirely removed by the knife. Hence it is necessary for the scirrhus to be also attended with the circumstances mentioned in the next number.

Not yet perfectly indurated.] For that stony hardness and rough surface denote the scirrhus to be confirmed, and that it may in a little time degenerate into a greater degree of malignity by the application even of the most mild resolving medicines. Such a tumour ought therefore to be capable of yielding as yet to an external pressure; otherwise there will be danger that the vessels will concrete with their inspissated juices into an irresolvable mass.

In a person of a good habit.] For since it was observed in the commentary to §. 485, that an atrabiliary cacochymy very much favoured the production of scirrhi; it is evident, that an attempt to resolve the impacted matter in some vessels will be of little service, if the same matter continuing in the blood renews the ob-

^b Orientes avertere, et nuper incipientes solvere oportet. De Curat. Morbor. Diuturn. lib. i. cap. 14. p. 128.

obstruction in a short time either in the same or in other vessels: or, for instance, if the mass of blood should have been affected with an acrid scurvy, there would then be great danger of a putrefaction by attempting to resolve a scirrhus with the application of emollient and discutient remedies.

So many cautions are required to render the cure of a scirrhus fit to be undertaken without danger! But fraudulent pretenders, crazy old women, and frequently the imprudent chymists, rashly confiding in their supposed secret remedies, despise the dangers of which they are ignorant, and after all their great promises hurry the deceived patient headlong into the greatest miseries.

When therefore it appears evident, from duly considering all the circumstances, that a scirrhus is as yet capable of being resolved; it may be then asked, What remedies are necessary to the cure? Certainly none but emollients, which relax the vessels; and gentle discutients or resolvents, which are capable of attenuating the concreting humours, without exciting any great commotion in them. Aretæus^c indeed says, that such remedies are to be used to soften a scirrhus hardness of the spleen, as very much resemble fire: but he immediately after recommends fomenting the parts with vinegar, oil, and honey; and orders a powder of the *glans unguentaria* to be sprinkled on; and, lastly, he recommends the most emollient cataplasms. Upon another occasion (§. 406) we mentioned the practical rules given us by Galen, where, treating concerning the cure of a scirrhus, he says, That if any one attempts to remove such a scirrhus by violent drawing and discutient remedies, without the use of such things as warm, moisten, mollify, and dissolve, he will imagine that he has made great advances towards a cure for the first few days: but afterwards what is left of the disorder will be incurable; inasmuch as all the thinner parts being dissipated, the remainder will be left like a stony concretion^d. The truth of this has been often appa-

rent

^c Ibidem.

^d Method. Med. lib. xiv. cap. 4. Charter. Tom. X. p. 322. et Method. Med. ad Glaucon. lib. ii. cap. 6. ibid. p. 379.

rent in the breasts of women who give suck, who, to prevent the tumours in them from coming to suppuration, rub them, and expose them to the heat of burning coals: and thus indeed the tumour is in a little time diminished, nor does it incline to suppuration; but then an incurable scirrhus afterwards remains. But nothing can be better in this case than to expose the scirrhus part to the vapours of warm water twice a-day, and then to use gentle frictions; applying afterwards an aromatic emplaster, more especially compounded of the ferulaceous gums, as those of galbanum, sagapen, ammoniacum, &c. of which there are several to be had in the shops. Fomentations and cataplasms formed of the same ingredients may be likewise used for the same purposes; and some examples of such forms may be seen in the *Materia Medica* corresponding to the number of this aphorism. By this method, continued for several months, I with pleasure recollect several recent scirrhi of the breast, which I have happily cured. I have likewise seen much service from a solution of Venice soap in milk, which being brought to the consistence of a thin poultice, was taken up with a sponge, and being laid to the scirrhus part was secured there by applying over it a hog's bladder oiled.

Acid fumes, and more especially those prepared from vegetables by fermentation, as vinegar, are of great service towards resolving a scirrhus. Even Galen^c recommends the use of this remedy: for he would have such things interposed betwixt the emollient applications as are capable of inciding and attenuating the matter of the scirrhus; and among those which incide, he recommends vinegar more than the rest. In the cure of scirrhus indurations of the tendons and ligaments, he extinguished a red-hot lapis pyrites, or instead of that a piece of mill-stone, in the most sharp vinegar, taking care that the scirrhus tendons and ligaments were held over the hot ascending vapours of the vinegar; and after this he again applied emollient remedies. Yet he feared that the substance of the tendons

^c Method. Med. lib. xiv. cap. 5. Charter. Tom. X. p. 323.

dons and ligaments might be injured by the too long and frequent application of the acid vapours of the vinegar; but for a scirrhus of the spleen or other fleshy parts, he says it might be safely used. He also observes to us, that he had contrived several medicines compounded with vinegar; and says particularly, that ammoniacum diluted in vinegar to the consistence of clay, being applied to a scirrhus spleen, made a complete cure without the use of any other remedy. But he very well observes in another place ^f, that the scirrhus indeed becomes softer by the use of relaxing medicines, but does not decrease; whereas they are considerably diminished in bulk by the application of those remedies which are compounded with vinegar: and therefore he recommends the use of them both alternately. He ^g recommends even the internal use of vinegar for the cure of scirrhusities in the viscera; and observes, that, in a scirrhus spleen, external remedies alone are not sufficient; but that it is also necessary to exhibit strong draughts made *ex cort. capp. rad. scolopendrii, myrica, &c.* the branches as well as the roots of the last boiled in oxymel or vinegar. The salutary use of vinegar in resolving scirrhi is also approved by modern practice and observation, whether by its vapours, or in the form of a fomentation, or mixed with the ferulaceous gums and applied in the form of emplaster. It has been a constant practice, in almost all of the shops, to dissolve gum ammoniacum, galbanum, opopanax, sagapen, &c. in vinegar; and, after straining them from their sordes, to dry them again with a gentle fire: But this preparation does not seem intended barely to cleanse these gums from their foul or foreign contained matters, but also that the sharpest part of the vinegar might unite with the gums, while the more thin and watery parts were exhaled in the inspissation, and that by this means the efficacy of these gums might be increased towards dividing and attenuating concreted tumours. It may be sufficient for our purpose to produce one instance of the efficacy of these

^f Method. Med. ad Glaucon. lib. ii. cap. 6. *ibid.* p. 379.

^g *Ibid.* cap. 7.

these remedies from Hildanus^h. A young and robust woman had an inflammation in her left breast during the time that she suckled her infant; after the inflammation went off, a hard tumour remained, which was in vain attempted to be removed by the application of various remedies from women and empirical practisers. Hildanus being consulted, ordered the infant to be weaned, and the breast to be daily anointed with a liniment, which among other things contained a good quantity of gum-ammoniacum dissolved in vinegar of squills, and at the same time he applied an emollient cataplasm twice a-day; and by this means, giving a gentle purge at intervals, the hard tumour was entirely resolved: and he affirms he met with the like success by the same means in another case of the like nature.

But there is perhaps no internal remedy of greater efficacy in this case than vinegar saturated with pure alkaline salt, or if to a pint of rhenish wine be added half an ounce of the salt of carduus benedictus or of bean-stalks, &c. taking half an ounce of this mixture three or four times a-day. The use of such remedies was also recommended by the ancients. For says Pliny, *The ashes of vine-twigs, of vines, and of vinaceous trees mixed with vinegar, heal condylomata and disorders of the anus;—a mixture of rue, and vinegar of roses, is serviceable in a tumour of the spleen;—and the ashes of vine-twigs sprinkled with vinegar is a remedy for the spleen*ⁱ. The fumes of burning sulphur are also recommended, directing them to the scirrhus part; but when the lungs are the seat of the disorder, it will be very difficult to apply this remedy. But even the known force of vinegar in dissolving the blood, may give us more reason to hope for a cure from thence in these cases; since the acid of sulphur, especially unmixed, coagulates the blood.

Concerning the efficacy of mercury in opening obstructions,
VOL. IV. Y

^h Observat. Chirurg. cent. i. p. 152.

ⁱ Cingrem farmentorum vitiumque et vinaceorum condylomatibus et sedis vitibus moderari ex aceto:—lenis tumori cum rosaceo ruta et aceto:—cingrem farmentorum ad lenis remedia aceto conspersum. *Hyper. Natur. lib. xxii. Proem. p. 588.*

structions, we treated before in the commentary on §. 135, n^o 4. and the use of it is often found serviceable for resolving scirrhus tumours, as well externally applied as taken internally; but this only in a benign and incipient scirrhus: for when the concreted matter is compacted almost into a stony hardness, and the scirrhus begins to be malignant, no relief can be expected from the use of the strongest mercurial preparations, nor even from a mercurial salivation itself; but rather all things will be rendered worse, and the motion of the humours being increased by these remedies, a scirrhus will be the sooner changed into a cancer by these means. But it is usual to apply with success *emplastrum de ranis cum mercurio*, when the scirrhus is resolvable, taking care at the same time that a salivation is not excited from an imprudent use of it; and therefore, so soon as the patient perceives any pain or tension about the gums, the emplaster ought to be removed, and the part to which it adhered is to be washed clean with soap. This emplaster is usually of great service for resolving scirrhus buboes from a venereal cause. The fumes of cinnabar will be serviceable, as well by its sulphur as the mercury, in these disorders; only it often raises a salivation very suddenly.

2. If the scirrhus does not yield to these means, it ought to be speedily and cleanly extirpated by the knife; provided the part in which it is seated, with the nature of the adjacent parts, its degree of mobility, the condition of the disorder, with the strength and healthy constitution of the patient, will permit.

But when all these means have been used for several weeks or months, and no diminution appears in the scirrhus, nothing more remains than to extirpate or remove it by the knife, that it may not continually put the patient in fear of a cancer. But it will be best to do this as soon as possible, because the longer such a scirrhus is left, the more it usually increases in bulk, and fre-

frequently adheres to the adjacent parts, whence the extirpation of it will be afterwards much more difficult, and even sometimes quite impracticable. Add to this, that the disorder very often propagates itself into the adjacent glands, and then there will be more scirrhi to be extirpated in order to complete the cure. For it is remarkable, that a large scirrhus very seldom continues long in the breasts in an irresolvable state, before it infects the subaxillary glands in the same manner. Thus I have seen, in a woman who had a scirrhus in her breasts from an external contusion, that by the frequent application of hot spirit of wine it was converted into a stony hardness; and not only the subaxillary glands, but almost the whole neck, breast, and shoulder, of the same side, were indurated. But a surgeon ought never to advise the extirpation of a scirrhus, unless he is certain that it may be entirely removed: for if but the least part of it be left behind after the operation, it may soon degenerate into a cancer, as we are assured by many unhappy instances. Before, therefore, it is concluded to extirpate the scirrhus, the following circumstances ought to be considered.

Part in which it is seated.] Which ought to be such as to give a ready access to the hands and instruments of the surgeon. For who would attempt, or even think of removing internal scirrhi? Yet Tulpius relates ^k, that he saw a scirrhus growing within the pudenda, equal to the size of one's fist, and covered with a thick and strong membrane, being internally white, and resembling the substance of the male testicle, which yet was extirpated by a skilful surgeon, without any injury to the adjacent parts, in a widow of fifty years old, who was by this means happily freed from the eminent danger that was threatened, as the scirrhus which was thus extirpated afforded pretty evident signs of its degenerating into a cancer.

Nature and seat of the adjacent parts.] More especially it is to be considered how the large vessels are disposed which lie near the scirrhus, since there will

be great danger of their being injured in the extirpation; as for instance, when a subaxillary or parotid gland is to be removed. Yet need not an expert surgeon despair in these difficult cases; for it is evident, from the most faithful observations, that by a prudent hand scirrhi may be extirpated even in those parts. Hildanus¹ extirpated a scirrhus in the breast of a woman which was already inclined to be cancerous; and at the same time he found it necessary to remove three other scirrhi seated under the axilla of the same side, one of them being equal to the size of an egg: yet he happily performed that dangerous operation; and by tying the vessels which led to the larger subaxillary scirrhus, he avoided the hæmorrhage which was there so much to be feared. Kaaw observes, that he had seen the parotid and submaxillary glands when scirrhus happily extirpated by a very skilful and expert surgeon of the Hague: and he has observed, in his most finished dissertation upon a scirrhus (which he wrote for his degree, and defended the same day in which his uncle the great Boerhaave died), that there is even no necessity of tying up the arteries after the parotid gland has been extirpated, but that the hæmorrhage may be suppressed by inserting a spungedipped in some astringent liquor. From hence it is evident how much may be done by an expert hand, even in the most dangerous cases.

Mobility.] Before it is determined to extirpate the scirrhus by the knife, it ought to be first made evident that the tumour is moveable towards all directions, and not attached to any part. For unless it can be totally removed, the least part of the remaining scirrhus will certainly degenerate into a cancer, as all the authors of observations testify. But every gland is lodged in the cellular membrane, and is with that naturally moveable towards all quarters. A scirrhus ought therefore to be first taken hold of by the fingers, and then moved upwards, downwards, and to each side; and if then it is equally moveable with ease in all directions, and does not adhere either to the sub-
jacent

¹ Observ. Chirurg. cent. 2. obs. 79. p. 150.

jacent or ambient parts, it is sufficiently free. Indeed the cellular membrane adheres to it on all sides; but that may be separated from it without any damage, and even without any considerable pain, as we shall explain hereafter under the present aphorism. Sometimes, again, this scirrhus is moveable enough below and towards each side, but adheres very firmly to the skin in its upper part, as may be easily discovered, since the skin in that part cannot be elevated; but even then also the scirrhus may be well enough removed, cutting out at the same time that part of the skin to which it adheres. But in that case the wound will be always larger, and a more unsightly scar will be left by reason of the lost part of the skin.

Condition of the disorder.] As, whether the scirrhus be solitary, or whether the others (if there are any) are resolvable, or whether it will be necessary to extirpate them also by the knife. For to what purpose would it be, for instance, to remove a scirrhus from the breast, if it appears from certain signs that the uterus is likewise scirrhus, or that the like disorder is present in the other breast, and which cannot be extirpated for the reasons to be given at no 3.

Strength and sound habit of the patient.] For all the views of art aim at the health of the patient. So that if the patient's strength is so much impaired, that there may be danger of his perishing, either from the violence of the pain, the profuseness of the hæmorrhage, or the great suppuration, which often follow the extirpation of these tumours when large; the extirpation would then be performed to no purpose. The same is also true when a cacochymy has affected the whole mass of blood; for then scarce the least wound can be brought to heal kindly, unless the ill state of the juices can be corrected or removed. Yet if there is danger that the scirrhus will soon turn into a cancer, it will be better to try a doubtful remedy, rather than submit to so certain and terrible a malady; and then it will be the part of every prudent physician to advise the extirpation of the scirrhus, even though it cannot be performed without danger.

After all things have been well considered, and it has been determined to remove the scirrhus, the next inquiry is, By what method that is to be done. Neither the actual nor potential cauteries take place here, unless the scirrhus is so small that it may be at once destroyed by those means: but even in that case it will be safer to extirpate them by the knife; for if there is but the least part remaining, there will be danger of a cancer. If a scirrhus tumour hangs pendulous in such a manner, as it seldom does, that the whole body of it projects beyond the surface of the adjacent parts, to which it is fastened as it were by a foot-stalk; in that case some advise to violently constrict the narrow neck by which the scirrhus adheres, by fastening round a ligature, so as to intercept all its nourishment, whence it will wither and fall off. But neither can this method take place, unless the surgeon is assured that no part of the scirrhus is thus intercepted within the ligature itself; for that part left behind in the ligature would degenerate into a cancer, even notwithstanding the rest of the scirrhus was to be separated. An unfortunate case of this nature was observed by the celebrated Boerhaave many years ago in this city of Leyden, when a large scirrhus tumour seated in the back, having a narrow neck, was attempted to be thus cured, even though they were sufficiently admonished that the worst consequences were to be feared. For two plates of brass being prepared for this purpose, and pressed together by degrees with screws, compressed the root of this tumour; but with very unfortunate success: for a terrible putrefaction invaded not only the scirrhus, but also the circumjacent parts; and exhaled such a putrid smell, that the patient was deserted by every one, even the surgeons not excepted, and fell an unhappy victim to this rash machinery.

The best method of all, therefore, seems to be, To remove an irresolvable scirrhus by the knife, and that as soon as possible. For there is danger, that, if the scirrhus be left longer, it will grow in bulk, and spread into the adjacent glands, or at least adhere to the neighbouring parts. Now a scirrhus is removed by incision

cision two ways: either by dividing the integuments, and taking out the scirrhus, as if it were a kernel from its shell; or else by extirpating the whole scirrhus, together with all its integuments, at one and the same time. The first method is indeed by much the safest, but is longer in performing; and can take place only for removing the smaller scirrhi, which do not adhere to the skin, but, being fixed in the cellular membrane, are moveable on all sides: But when the scirrhus is larger, or adheres to the skin, the latter of these methods is to be used; that is, the extirpation is to be performed in the same manner as for removing a scirrhus breast. In order to remove a scirrhus by enucleation, the integuments being stretched by the surgeon's hand, the skin and panniculus adiposus are divided down to the scirrhus without injuring it. But this incision through the integuments is various according to the size of the scirrhus; which if small requires only a longitudinal incision, but when large a crucial one. Then the integuments being elevated by small hooks, their corners are to be separated from the scirrhus by the knife, until the whole is exposed or laid bare in its anterior part: and after this, the forceps of Helvetius is to be entered into the substance of the scirrhus, and gently drawn outward, that it may be more commodiously freed on all sides by the knife, in order to its extraction. Since the scirrhus gland is seated in the panniculus adiposus, it may be separated from thence without much pain, except in those places where the vessels enter the scirrhus. After the scirrhus is removed, and the hæmorrhage is suppressed, it must be carefully examined whether any part of the scirrhus is left behind; and then the rest of the cure is to be conducted as in a wound with a loss of substance, concerning which we treated sufficiently in the history of wounds in general. This method of enucleating a scirrhus, with all its cautions, is very exactly described in the dissertation of Kaaw before recommended, who had seen the operation performed by a very expert surgeon. He justly cautions the operator not to pull the scirrhus imprudently while
it

it is separating; for the tension by that means made upon the nerves will not only excite the most severe pain, but may sometimes produce fatal convulsions even a considerable time after the operation has been performed. Equal care ought also to be taken not to irritate the surface of the crude wound with acrid styptics or the like, which powerfully coagulate the blood: for the grumes of concremented blood lodged in the divided veins, may pass inward through those diverging vessels to the heart and lungs, where they may give rise to a polypus. But scraped lint pressed upon the part with a suitable bandage, will be generally sufficient to answer that intention; also the orbicular fungus, bovista, or puff-ball, is likewise of good use to suppress the hæmorrhage.

But in extirpating a scirrhus, together with its incumbent integuments, after the manner required for extirpating a breast, the incision must pass through the panniculus adiposus under the scirrhus, without injuring the subjacent parts. To perform this, the scirrhus is elevated from the subjacent parts, either by the fingers of the surgeon only, or by passing needles or the forceps of Helvetius through the substance of the scirrhus which is to be raised; or else, a fork being passed through the cellular membrane betwixt the scirrhus and subjacent parts, the incision is to be made under the fork, pressing the knife close to that instrument so as to pass through the cellular membrane, and divide all the intervening parts; and in the mean time, by elevating the fork while the incision is made, the scirrhus will be raised, and by that means the subjacent parts will be preserved from being injured by the knife. A different method is to be chosen by the surgeon according to the different size of the scirrhus, and nature of the part in which it is seated. But the extirpation of a scirrhus in this manner cannot be performed without leaving a large wound remaining, whence there will be always danger of exhausting the patient by the too great suppuration; or else the matter being collected in so large a wound, and absorbed by the bibulous veins, may infect the blood with a purulent

erulent cacochymy. Therefore the former method of enucleating a scirrhus appears to be the safest; since that is never attended with so great a suppuration, and the wound is always healed in a much shorter time. But these operations may above all be most happily performed, if the surgeon is assisted by skilful and intrepid persons who know how to compress the divided arteries with their fingers during the operation, which will not then be disturbed by the impetuous flowing of the blood.

3. If the scirrhus is of long standing, and appears to be malignant from its colour, hardness, roughness, itching, and incipient pain; or if its situation, adhesion, and nature of the adjacent parts, in a person of a bad habit, renders the extirpation of a scirrhus impossible; in that case every thing is to be carefully avoided, which increases the circulation of the blood, either throughout the whole body or in the part itself, to prevent the scirrhus from turning into a cancer. Hence therefore emollient, suppurative, corroding, caustic, and drying medicines, are in this case prejudicial.

In the preceding numbers of this aphorism we treated of the means by which a scirrhus might be resolved, or removed by extirpation; but in the present number we are to consider that state of a scirrhus, which neither admits of a resolution nor of extirpation. The impossibility of resolving a scirrhus may be known from its age, the colour of the integuments being changed into a red, purple, or livid, together with its stony hardness, and the roughness or inequality of the surface of the tumour. But when to all these an itching is also joined, there is much greater danger that the scirrhus may in a little time turn to a cancer; for then the concreted parts of the scirrhus begin to be put in motion, and gently distended by the nerves dispersed
though

through its substance ; from whence an agreeable tillation follows, and at length a troublesome itching, insomuch that the patient cannot forbear scratching or rubbing the part, even though he is told that a most severe cancer will by that means follow. If, again, the itching is soon followed with a pain, the danger is still greater. That the extirpation of such a scirrhus is impracticable, is known from its adhering so firmly to the adjacent parts that it cannot be cleanly separated from them, or from its being seated in some part to which the hands of the surgeon can have no access, or lastly from the adjacent large blood-vessels rendering the operation extremely dangerous: in all which cases, however, much may be hoped for from the dexterity of a skilful and intrepid surgeon. But if such a malignant cacochymy has infected the mass of blood, that one can hardly expect to heal the wound which is left after the extirpation of the scirrhus ; or if there are other scirrhi which begin to appear in different parts of the body ; it is then easily apparent, that the performance of this operation would be to no purpose. Since therefore, in this case, the disorder is incurable by all the power of medicines, or even by manual operation itself, all that art can do in such a case is to keep the disorder carefully in the same state, and prevent it from growing worse. This is that case, concerning which Hippocrates says, in the place cited in the commentary on n^o 1. of the present aphorism, that it is better not to undertake the cure of those afflicted with occult cancers, because they sooner perish by the cure, whereas they survive longer without it : for a scirrhus under the forementioned circumstances may be very justly termed an occult cancer. But we observed before (on §. 488), that an irresolvable scirrhus speedily changed into a cancer, by an increased motion of the humours, either throughout the whole body, or in the part itself affected. Therefore all remedies which produce this effect, under whatever denomination they may be recommended, are prejudicial. For a suppuration can never be procured, so as to separate an irresolvable scirrhus from the sound parts ; but a malignant

nant and incorrigible putrefaction follows, which eats away all the adjacent parts, as we shall declare hereafter in the history of a cancer. But so long as the scirrhus is contained in its integuments, it is tolerable although it inclines to a cancer; but when these integuments are broken, an ulcerated cancer follows, which rages with ungovernable malignity. Hence therefore the application of all emollient and suppurating remedies will hasten this disorder, by diminishing the cohesion of the integuments; but caustics and corroding medicines will produce the same bad effects much sooner and in a greater degree. How prejudicial the application of emollients is to an inveterate scirrhus, may appear from the observations of Hildanus^m; and I have myself sometimes seen scirrhusous breasts in a little time turned to ulcerated cancers by the application of such remedies, which were intended by the crazy old women to induce a suppuration. Etmuller^a advises to leave an incurable scirrhus altogether untouched; or else to reduce it to a stony hardness by the application of nitre dissolved in vinegar: but even this last seems to be dangerous, since the increased hardness of the scirrhus denotes a greater degree of malignity in it, and since it would be also irritated by these acrid remedies; and this more especially when the scirrhus begins to have shooting pains, is painful to the touch, and of a livid colour, as that author describes the scirrhus to be in which he advises the application of those remedies. Those things therefore are most advisable in this case, which prevent all inflammation, or which abate an inflammation when once formed, in order to secure the scirrhus from degenerating into a worse state; since the obstinacy of this disorder surpasses all the assistances of art hitherto known.

4. But in this last state of a scirrhus, n^o 3. none but anodynes, and such as quiet the motion
of

^m Observat. Chirurg. cent. 1. obs. 89. p. 69.
Tom. II. part. ii. p. 1238.

^a Oper. Med.

of the humours, with mild, saturnine, and mercurial remedies, are proper to be used.

In this case emollient pot-herbs will be convenient in the diet, with broths of recent flesh, milk, bread, soft and ripe garden fruits, &c. as may be seen in the *Materia Medica* corresponding to this number of the present aphorism. As to drink, milk diluted with water, soft and new ale, decoctions of barley, oat-meal, and the like, may be used. All violent passions of the mind are to be diligently avoided, and prudently suppressed if they are once raised. All acrimonious, heating, and stimulating substances are here highly pernicious. If, now, shooting pains or a troublesome itching are perceived in the scirrhus part, they are to be allayed with anodynes, as well internally taken, as externally applied; of which various forms may be seen in the *Materia Medica*. But if the integumentis of the scirrhus begin to inflame, endeavours must be used to relieve that by the prudent application of saturnine remedies: of which the chief are, Litharge dissolved in vinegar, and diluted with much water; The *unguentum nutritum*, composed of an intimate mixture of the same solution of litharge in vinegar, with oil of the solanum of the shops; and, The *emplastrum diapompholygos*. The itching may be also allayed by the same remedies. The scirrhus part is to be covered with very soft leather, to defend it from any attrition by the clothes, by which the integuments might be easily excoriated. Hence, if the breast is scirrhus, women ought never to wear stays made with whalebone, nor addict themselves to hard labour; since the scirrhus would be then agitated by the subjacent pectoral muscle. Mild mercurial applications are here of the greatest service; such as an amalgam of mercury and lead, mixed with *emplastrum diapompholygos*, which has been found very useful everywhere the integuments of the scirrhus were already begun to be inflamed: others recommend a thin plate of lead, rubbed with mercury, to be applied and adapted to the figure of the scirrhus. But when mercurial,

curels are applied to a scirrhus, great care is to be taken to avoid a salivation, which might be raised unexpectedly, and which would be always prejudicial here, since the motion of the humours would be thus increased without being able to resolve the scirrhus concretion, and the acrimony of the humours being also increased it would by that means be inclined to degenerate into a cancer.

§. 491. **I**F at the same time the patient is of a bad habit, that ought more especially to be corrected.

Since the whole design in this method of cure, which is by physicians termed *palliative*, aims at keeping the scirrhus under, and preventing it from degenerating into a cancer, it must be sufficiently evident, that the morbid temperature or habit of the patient ought to be corrected when any such appears. It was said before, in the commentary on §. 485, that an atrabiliary temperature very much favoured the production of a scirrhus, and therefore the same disposition will also augment a present scirrhus; hence, then, the diet and medicines ought to be such as may correct that distemperature, of which we shall treat hereafter under the Melancholia. But such remedies are to be also chosen, as to dissolve the tenacious atrabiliary humours, avoiding every thing which has any considerable acrimony. Hence honey, Venice-soap, with the mild attenuating juices or decoctions of herbs, are chiefly serviceable; such as those of succory, endive, fumitory, dandelion, &c. But if an acrid scurvy also afflicts the patient, that ought to be corrected or mitigated by suitable medicines; since an acrimony attending a scirrhus may increase its malignity, and soon turn it into a cancer, as will be more apparent in the following history of that disorder.

Of a C A N C E R.

§. 492. **I**F a scirrhus (392) of long standing and considerable bulk, is so irritated from thence, or from the motion of the adjacent parts, that the vessels in the circumference of the scirrhus are inflamed, it then becomes malignant, and is from its similitude termed a Cancer or Carcinoma.

We come now to one of the most lamentable disorders which afflict the human frame, and which has never yet appeared to have been cured, unless by removing the disorder together with the diseased part. Nor is this disorder terrible only from its obstinacy, by which it resists the action of all means whatever; but it is also to be feared more upon account of the severe pains which it creates, and for that intolerable putrefaction by which it gradually eats through and destroys the living body. Add to all this, the long continuance of the torments, with which the unfortunate patient is sometimes afflicted for many months, or even years, before death, the ultimate remedy of all ills, puts a period to his misery: For unless the patient is lost by a profuse hæmorrhage from an erosion of the larger vessels, life is usually dragged out for a long time, before the body is destroyed.

This disorder has been usually denominated *carcinoma*, or a *cancer*; which name Galen^a will have to be given it from its having some similitude to the crab-fish. For as that animal spreads its feet on all sides, so the veins which come out on all sides from a cancer appear distended with dark-coloured blood. To this Ægineta^b adds, that a cancer most obstinately adheres to the part which it has invaded, in the same manner as the crab-fish with its claws most firmly holds the prey which it has caught; and from thence he deduces a greater similitude. But from what has been said

^a Meth. Med. ad Glaucon. lib. ii. cap. 12. Charter. Tom. X. p. 390

^b Lib. iv. cap. 26. p. 66.

in the commentary on §. 419, it is evident, that Celsus^c intends and describes a gangrene and sphacelus by the term *cancrum*; and that he uses the term *carcinoma* to denote that disorder which the modern physicians and surgeons promiscuously call both by the name of *cancrum* and *carcinoma*. For although the description which Celsus gives of a carcinoma may seem to be in some measure obscure, yet it is sufficient to demonstrate that it is this disorder which he so calls. For he says the disorder happens principally about the face, ears, nose, lips, and in the breasts of women, and that the pains are as it were incurvated about it: and he likewise remarks its great malignity, and how easily it may be irritated by incision or cauterization. But he even affirms, that no medicine was ever serviceable in these maladies: for by cauterization they are immediately exasperated, and increase till they kill the patient; and that, even after extirpation, they return after the wound has been cicatrized, and occasion the death of the patient. From all this it is sufficiently evident, that Celsus has described under the name of *carcinoma*, that disorder which the moderns term a *cancer*.

A cancer is the consequence of a preceding scirrhus, or rather a scirrhus is changed into a cancer. But whether or not a cancer may arise in any part of the body without a preceding scirrhus, is a different question: but I believe it will appear, from the commentary on §. 496, that a disorder of the like malignity and horrid effects is observed in many parts of the body where no scirrhus pre-existed. But in what manner does a scirrhus turn into a cancer? and by what signs is it distinguished from a cancer? A scirrhus is by the universal consent of all physicians termed an hard indolent tumour, (see §. 392.) But when a scirrhus turns to a cancer, the tumour remains, and only the pain invades which was not there before. The pain therefore is the distinguishing sign betwixt a scirrhus and a cancer. But as there is a great deal of difference betwixt a scirrhus degenerating into an incipient cancer, and a confirmed cancer which is already ulcerated, it is evident

that this disorder runs through several degrees before it arrives to the worst kind of malignity; and therefore it is that some authors retain the name of *scirrhus*, even when the pricking pains are present. But in that case it is better, for the sake of distinction, to term the disorder rather an *occult* or *latent cancer*, than a *scirrhus*, as we shall presently observe in §. 494.

The cause of a *scirrhus* was demonstrated, in the commentary on §. 484, to be every thing capable of coagulating, inspissating, or drying up the juices separated by the fabric of a gland, and collected in the secretory or excretory ducts, or in the follicles; or which renders the impulse of the arterial blood insufficient to propel the humours contained in the follicles, as if they were out of the course of the circulation; while at the same time the intricate vascular structure constituting the gland also renders the impulse of the arterial blood incapable of resolving the concreted matter, so as neither to remove the obstruction, nor to procure a laudable suppuration to cast off those parts which are no longer obedient to the laws of circulation. The concreted juices therefore stagnate in the vessels, or in the hollow follicles and cells, whose sides are composed of all sorts of vessels; and there the matter may continue for a long time unaltered, and without any considerable damage, as we are assured from daily observation. For frequently no more than the function of a *scirrhous* part is injured; or sometimes the actions of the adjacent parts are also disturbed, as being compressed by the *scirrhus*. But when from any cause the motion of the humours is increased through the living and pervious vessels which are placed round the substance of the *scirrhus*, it is evident, from what has been said at §. 375, that an inflammation may be there easily produced, even though these vessels, compressed and straitened by the *scirrhus*, were before capable of transmitting the humours while they passed with but a gentle motion; but the circulation being accelerated, they are immediately obstructed. But an inflammation being thus produced round the *scirrhus*, all its consequences (§. 382) may follow; namely, pain, violent attrition, and

and from thence a heat and burning upon the part. But it was demonstrated, in the commentary on §. 84, that the motion of the humours being accelerated, and their heat increased, very much disposes them to putrefaction. The concreted humours therefore of the scirrhus, which have hitherto lain in a mild unactive state in their containing obstructed vessels or receptacles, begin to corrupt or putrefy, and acquire a greater acrimony, by which they may be capable of irritating or corroding the parts in which they are contained. It is therefore no wonder that a pain should follow in this case, by which, as we said before, a cancer is distinguished from a scirrhus. The same consequences will follow, if the adjacent vessels, compressed by the contiguous scirrhus, are inflamed; for it is then easily apparent, that in a little time the inflammation will be extended into the substance of the scirrhus itself. Hence it is, that scirrhus breasts in women are often so suddenly changed into cancers, more especially those who are obliged to get their living by manual labour: for then the hard scirrhus is pressed against the adjacent vessels, which are by that means inflamed; whence the scirrhus in a little time degenerates into a cancer. If therefore a scirrhus, gradually increasing, compresses the adjacent vessels, it will in a little time become a cancer. But besides this, the concreted substance of the scirrhus itself may at length become spontaneously acrid, and produce all the same maladies: for it was said before, at §. 485, that an atrabiliary matter in the blood very much favoured the production of scirrhi; and even the ancient physicians have deduced the origin of scirrhi almost entirely from this cause, and also directed the cure wholly to the resolution and evacuation of that matter from the body.

But it will appear from what will be said hereafter concerning the Melancholia, that this atrabiliary humour, which has almost the tenacity of pitch, does by long rest and stagnation become acrid and corroding, and that then it produces the worst maladies. The same may therefore happen in a scirrhus, more especially when the patient is of an atrabiliary habit; and

thus a scirrhus may become malignant with age, even without the assistance of any other cause.

§. 493. **I**N which disorder (492) we discover different degrees of malignity, even in the first stage, according to the degree of inflammation in the adjacent parts, the excess of the putrid acrimony in the part affected, the dignity or importance of the part itself, the number and condition of the annexed glands, and the temperature of the whole habit.

When only some few appearances denote that a scirrhus is beginning to degenerate into a cancer, it is then said to be *malignant*; and that very justly, on account of the terrible maladies which afterwards follow. But this malignity is more or less, and sooner or later changes the disorder into its worst stage, in proportion to the several circumstances mentioned in the following paragraphs.

Degree of inflammation in the adjacent parts.] A *slight* erysipelas, or a *slight* inflammation, in the parts round a scirrhus, or even seated in the integuments of the scirrhus, may be frequently removed by the prudent application of a saturnine plaister, a solution of litharge in vinegar diluted with much water, or the like; and thus a scirrhus may be prevented from speedily degenerating into an ulcerated cancer. But when a *violent* inflammation is formed either in the integuments of a scirrhus, or in the circumambient parts, the very worst consequences are to be soon expected.

Excess of the putrid acrimony in the affected part.] The principal malignity of a cancer consists in a putrefaction of the scirrhous matter, confined in the vessels or receptacles which are as yet living, and by the putrefaction of which the virulent matter corrodes and ulcerates all the circumjacent parts in contact. But the disorder does not extend immediately to this last degree of malignity, even in ulcerated cancers; but proceeds slowly, and by degrees. Therefore, the greater the

the degree of putrefaction, the worse will be all the consequences. In ulcerated cancers, the greater or less degree of putrefaction and acrimony may be well enough discovered from the smell of the discharged matter, and the manner in which it corrodes the adjacent parts; but, in occult or latent cancers, the different degrees of incipient putrefaction are denoted by the itching, heat, pricking pains, and bulk of the scirrhus suddenly increasing.

Dignity or importance of the part.] For if, for instance, the pancreas, stomach, liver, intestines, &c. are injured with a cancer, much more severe symptoms will follow, and the prognosis will be much worse, than if, for instance, the disorder was seated only in the breasts.

The number and condition of the annexed glands.] A solitary cancer is longer tolerable and less troublesome to the patient, than if the same disorder was seated in several different parts of the body; and therefore the disorder will be worse when seated in such a part as may favour the spreading of the disorder thro' the adjacent glands. A large scirrhus which threatens a cancer, hardly ever continues long in the breast before the axillary glands of the same side begin to be scirrhus, as we are taught by daily observation: And it is very frequent for the other breast to be also affected, when a scirrhus has continued a long time in either of them. And as there is so near a relation or affinity betwixt the uterus and breasts, we accordingly observe, that frequently the uterus begins to be likewise affected with the same disorder. This is confirmed by an unhappy case which came within the knowledge of the celebrated Boerhaave. The mother of an honourable family having a cancer in her right-breast extirpated before it was yet ulcerated; in about a year after, the like disorder invaded her left breast, and was also extirpated; but after this she languished, and had all the signs of a cancer invading the uterus, till at length after the most severe tortures she expired. It was said in the history of a scirrhus, that it appeared from practical observations, that when all the glands

of

of the neck were indurated, all the glands of the mesentery were likewise affected in the same manner: in vain, therefore, would it be to attempt a cure in these cases, while the disorder returns into the other communicating glands.

Temperature of the whole habit.] An atrabiliary temperature is apt to produce scirrhi, as we observed in the commentary on §. 485; and therefore the same temperature may likewise increase a scirrhus when it is once formed. But a scirrhus, by increasing in bulk, changes into a cancer, as is evident from §. 492: it is therefore apparent that there must be the greatest danger of a future cancer, in those of a dry, lean, and atrabiliary habit of body; but most of all, if that atrabiliary juice predominating in the blood begins to dissolve and become acrid, as will be hereafter more apparent at §. 475. namely, that any acrid humour mixing with a scirrhus, changes the same into a cancer. The like will be also true, when, for instance, a putrid scurvy afflicts the patient; for a scirrhus seldom continues long in such habits of body before it becomes malignant.

§. 494. **I**F the cancer remains confined within its proper integuments, it is said to be *occult* or *latent*; but if these integuments are ruptured by an ulcer, the cancer is then termed *open* or *ulcerated*: The latter follows after the former.

A scirrhus, as we have frequently observed, is a hard indolent tumour in a glandular part: But when a titillation, itching, pain, and heat, are perceived in this tumour, it is no longer termed a *scirrhus*, but a *cancer*. So long as the cancer remains confined in its proper integuments, these not being yet eroded, it is said to be *occult*: But when it is degenerated into such a degree of malignity, as to corrode the integuments, and discharge a sanies or foul matter, it is then termed an *open* or *ulcerated* cancer. We read in Aetius^a, that

Philo-

^a Tetrabibl. IV. Serm. iv. cap. 43.

Philoxenus called that an *occult cancer* which lay in some concealed part of the body; as for instance, in the uterus or intestines: and others have been of the same opinion after him. But Hippocrates seems to have been of another opinion; for in the place cited from him in the commentary on §. 485, he calls this disorder seated in the breasts, an *occult cancer*. For in treating on a retention of the menses, from a displacing of the os uteri, he says that the retained menses are transferred to the breasts, and deceive the women with a false shew of pregnancy: and he afterwards adds as follows: *And in the breasts hard tubercles arise, sometimes large, and sometimes but small; but these do not suppurate, but always grow harder; and from these afterwards arise occult cancers*^b. From whence it is evident, that Hippocrates distinguished a scirrhus from an occult cancer; and that he also called a cancer *occult*, even though seated in the external parts of the body. But that an occult cancer must always precede an open or ulcerated one, is very evident from what has been already said.

§. 495. **T**HE cause of a cancer may be every thing producing a scirrhus (484, 485), or which joins an acrimony to a scirrhus; a change in the circulating humours, from a suppression of the menses, piles, or any other usual hæmorrhage; barrenness; a single life; the age of sterility, or being past child-bearing, from forty-five to fifty; a sharp, hot, or austere diet; melancholy; angry passions of the mind; any kind of irritation externally, whether from motion, heat, acrimony, or the use of emollient, suppurating, caustic, or blistering remedies; or the like acting internally.

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^b Et in mammis tubercula dura oriuntur, quædam majora, quædam vero minora: hæc autem non suppurantur, sed semper duriora sunt: ex his deinde occulti cancri nascuntur. *De Morb. Mulier. lib. ii. cap. 20. Charter. Tom. VII. p. 808.*

We come now to treat of the causes by which an indolent scirrhus may be changed first into a *latent* cancer, and afterwards into an *ulcerated* one. But every cause which produces a scirrhus, may be likewise considered as the remote cause of a cancer; and the same cause continuing to act, may increase the already formed scirrhus, and by that means convert it into cancer.

Which joins an acrimony to a scirrhus.] Whether the matter of the scirrhus itself by lying corrupts and changes into an acrid state, or whether the mild nature of the healthy juices is perverted by disease, a scirrhus which has hitherto lain dormant may be either way irritated so as to turn soon into a cancer. The same consequence will also follow from feeding upon acrimonious aliments, and such as are not easily capable of being attenuated and changed by the powers of the vessels and viscera: such are most of the spices, especially garlick and onions; after feeding upon which the sweat and urine smell of them for a considerable time. From hence it is evident how treacherous a disorder a scirrhus is, however mild it may seem in its own nature. But, even if every thing acrid is avoided in the diet, what person can be secure from the epidemical disorders which spread universally, and by which the mild disposition of our humours is so frequently altered. Add to this, that these acrid substances offend likewise by increasing the velocity of the circulation; from which alone a scirrhus may be converted into a cancer, as we said before. It is evident, from many practical observations, how dangerous the use of acrid substances in these cases is, and it may be sufficient for us to give one instance. In a certain nobleman, after the coats of the eye were ruptured by a severe ophthalmia, and all the humours discharged, the collapsed eye-lids grew together; and he survived after this for the space of fourteen years, without any bad symptom; but at that time, using plenty of wine and of aliments difficult to digest, with spices, onions, garlick, leeks, horse-radish, &c. of which he eat greedily, the disorder which had lain

long dormant, broke out into action. For the eye-lids, which had been hitherto closed, began to open; and a hard tumour grew out from the bottom of the orbit, of a livid colour and malignant nature; which at length protuberating beyond the eye-lids, larger than a goose-egg, afforded a horrid spectacle. ^a Hildanus happily extirpated this cancerous tumour from the bottom of the orbit, and cured the patient. Hence Galen ^b justly recommends the use of ptisans, cream, whey of milk, soft pot-herbs, mallows, orach, shell-fish, &c. in the diet of those who are afflicted with a cancer.

A change in the circulating humours, &c.] See what has been said on this subject in the commentaries to §. 485. For it there appears, from the testimony of Hippocrates, and the observations of the best writers, that not only scirrri arise when those wonted evacuations are suppressed, but also that scirrhi first formed do from the same cause soon degenerate into cancers. But scirrhi of the breasts, or those which are seated in or near the uterus, are more especially irritated by a suppression of the menstrual discharge.

Barrenness.] In the commentaries on §. 486, it was observed, in treating on the effects of scirrhi formed in various parts of the body, that sterility was frequently the consequence of a scirrhus seated in the genital parts; and even that this seems to have been the most frequent cause of barrenness, as far as we can be informed by medical observations. It is therefore not without reason that physicians suspect a latent scirrhus in barren women, which by age and increasing in bulk usually degenerates into a cancer. To this add, that, in the time of gestation, all the vessels composing the substance of the uterus, are so opened and dilated in their capacities, that they either remove incipient obstructions, or at least acquire such a disposition as afterwards more easily to transmit the humours without being obstructed: and hence it is that impregnation is so frequently of service in those women who have a suppression or an irregular discharge of their menses, from

^a Observ. Chirurg. cent. 1. obs. 1. p. 1. &c. ^b Method. Med. ad Glaucon. lib. ii. cap. 12. Charter. Tom. X. p. 390.

from the vessels of the uterus not being sufficiently dilatable.

A single life, or the age of sterility.] This is also demonstrated from practical observations. For, as we said in the commentaries on §. 485, Dionis has observed, that a fourth part of the women afflicted with cancers have that disorder betwixt the forty-fifth and fiftieth year of their age; and he adds, that he most frequently observed that those afflicted with this disorder led a single life. The like is also testified by Vesalius.

An austere, acrid, and heating diet.] It has been observed before, at §. 485, that an atrabiliary matter frequently gives birth to a scirrhus; and it is evident from what is said in the commentary on §. 493, that from the same cause a scirrhus may be augmented and disposed to the malignity of a cancer. All things therefore which increase the atrabiliary juice in the blood, or render it more acrid by exciting a greater heat and motion, will be highly pernicious. But (as we shall hereafter explain more at large, when we come to treat of the Melancholia, §. 1093.) austere, hard, dry, and earthy aliments, taken for a constancy, and joined with rest or inactivity of body, generate this atrabiliary humour in the blood; whence the causes of a future scirrhus and cancer will be increased. Every thing acrid or heating ought therefore to be carefully avoided in the diet, because they may offend by increasing the motion of the humours, as was said but a little before.

Melancholy, and angry passions of the mind.] When high-minded people retain past injuries in their memory, and by that means cherish anger in their breasts, they very often fall into a very bad kind of melancholy; so that after being afflicted for a long time with the worst chronical disorders, they at length perish. It is no wonder therefore that scirrhi should be from thence generated, which were not before in being; or that those which are already formed should from the same cause be changed into cancers; since these me-

lancholy

lancholy affections of mind are most apt to follow in an atrabiliary constitution. But anger may be justly termed an affection of the bile, and may be very injurious to a scirrhus, since it diffuses a great heat throughout the whole body, increases the motion of the humours, often excites a violent fever with a turgescence and redness of the whole body, as Persius observes :

—————*calido sub pectore mascula bilis*
Intumuit, quam non extinxerit urna cicuta.

SAT. V. 144.

So that from an increased motion there is great danger of a scirrhus turning into a cancer.

Any kind of irritation externally; by motion, heat, &c.] All these, under whatever title comprehended, must be ever pernicious. For an irresolvable and confirmed scirrhus will never be attempted to be cured by any prudent person otherwise than by extirpation only : but when that cannot be attempted, nothing remains but to preserve it in the same state unaltered as long as possible, for every change or alteration will incline it towards a cancer. Friction, where there are any hopes of a resolution, is the chief remedy ; but this soon changes a malignant scirrhus into a cancer : heat also, evaporating the most fluid humours, converts a scirrhus either into a stony hardness, or else into a putrid state, which is here so much to be feared ; and how pernicious emollient, suppurating, and corroding applications are, has been said in the commentaries c. §. 490, n^o 3. Hence it is a general and practical rule, in the cure of such a scirrhus, to admit nothing into the body which may increase the motion or heat of the blood and humours, nor to apply any thing externally to the scirrhus which may give the least irritation. A piece of soft leather, or a saturnine emplaster, to keep off the attrition of the clothes, is all that can be allowed.

§. 496. **T**HE parts invaded by a cancer, are the same with those of a scirrhus (484.)

Since a cancer generally arises from a scirrhus, it
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must evidently occupy the same parts. But it seems to follow from practical observations, that a cancer or at least a disorder exactly like it, may arise in parts of the body even where no scirrhus has preceded. For instance, in the lips, a fungous tumour immediately begins to sprout up, when the thin membrane with which they are covered is split either by the cold or any other cause. This tumour often appears soft to the touch, gradually increases, and is expanded to a considerable bulk; it is attended with pain, discharges a malignant ichor, corroding the adjacent parts, which bleed; and, in fine, proving stubborn to all remedies it truly resembles the nature of a cancer; insomuch that, if not timely extirpated, it eats through all the adjacent parts in the same manner as is usual in an ulcerated cancer. In the tongue also, the nervous papillæ being denudated of their confining integuments, expand into a fungous mass, which degenerates into the same malignant disposition with a cancer, as we are assured by many unhappy instances. The like malignant degeneration is also sometimes observed in the nervous papillæ of the penis. A remarkable instance of this kind is given us by Hildanus ^a. A blacksmith from his infancy had a kind of wart upon the extremity of the glans penis, not larger than a pea, which gave him little or no trouble so long as he lived single: but after he had taken a wife, it was attended with intense and continual pain, insomuch that he was obliged to abstain from the conjugal offices for the space of thirteen years. In process of time this wart degenerated into a horrid cancer; and grew to so large a size, that it equalled the head of a new-born infant: the whole penis was changed into a livid, unequal fleshy mass, corroded in many places with ulcers; through which the urine discharging itself, added to the malignity of the whole. The stench was so intolerable, that the patient was deserted both by his family and friends. After numerous remedies tried to no purpose, the patient being given over by every body, Hildanus extirpated the whole penis, and happily cured the man; who

^a Observat. Chirurg. cent. 3. obs. 88. p. 272.

who was afterwards stronger in body, and more capable of working at his usual business, surviving ten years after the cure. But it appears from anatomy, that in the tongue, lips, and glans penis, there are numberless nervous papillæ extremely painful, when the thin cuticle which covers them is destroyed; and these papillæ seem to degenerate into this horrid disorder, most frequently in the parts already mentioned, and in others of the like nature where they are covered only with a very thin membrane. But the like disorders have been observed not only in these parts, but also where the skin itself is seated. Thus I observed, in an adult virgin, a large wart fixed in the back, which she had from her infancy, and which in process of time increased, and at last degenerated into a cancer from the attrition of too tight whalebone stays. But as this tumour hung as it were by a small stalk, therefore the surgeon constricted it by ligature, whence the wart in a little time fell off; and he afterwards corroded the part where it adhered with lapis infernalis: but a little after, a large malignant fungus grew up, and the adjacent skin became indurated; and while he was thinking of extirpating the horrid disorder, the patient was taken with another disease, of which she died. Thus I also saw, in a country-man, a fungus of the like nature which grew out from one of the toes, and came by an imprudent cutting off the nail by the hand of a surgeon, whereby he injured that tender nervous pulp which is seated under the nail: while the surgeon endeavoured to consume this fungus by caustics, the irritation was so great as turned it into a horrid cancer, whence the part was obliged to be afterwards extirpated. If now any one would have those warts, which are generally hard in parts covered with the skin, to be comprised under the general definition of a scirrhus, by reason of their hardness; yet it may be objected, that such fungous excrescences frequently arise in the lips, tongue, &c. which are no less malignant though they are soft. Therefore it may perhaps not be improper, for distinction's sake, to call those which arise in this man-

ner from a degeneration of the nervous papillæ, *fungous* cancers.

But since it is evident from the injections of Ruysch, that these nervous papillæ are composed not only of the pulpy substance of the nerve, but also of numerous small blood-vessels; therefore all those vessels do at the same time degenerate, and increase in bulk: and from hence it is that so dangerous an hæmorrhage has so frequently followed from an imprudent extirpation of malignant warts. Yet it does not seem improbable, but that the proper substance of the nerves themselves does also degenerate in this disorder. For the most acute pain seated in these fungous cancers, as well as in a scirrhus inclining to a cancer, demonstrates that the nerves dispersed through these parts remain as yet in their vital state. And it was made sufficiently evident in the commentaries on §. 268, 295, how easily the substance of the brain itself arises up into a fungous excrescence, when it is not confined by the containing skull and membranes. The nerves conveyed to the several parts of the body are securely defended, as well as confined, by tough membranous cases; but where those tough coverings are deposited from the nerve, its soft substance is there expanded, as for example, in the tongue, glans penis, the internal surface of the eye-lids, &c. where they are only confined by the superincumbent cuticle, which, when eroded or destroyed by any other cause, occasions the sprouting up of such fungous excrescences. It is therefore fit both for the surgeon and physician to be acquainted, that a cancer may be often feared although there has been no preceding scirrhus.

§. 497. **A**N occult cancer is known from the signs of a scirrhus (487) having preceded, and being followed with a titillation, itching, heat, redness, pricking, burning, or shooting pain; a reddish, deep red, or purple colour, or else a blue, livid or black; extreme hardness, inequality, and roughness, with a protuberant point:

to

to which add, an increase of the tumour; and a distension of the adjacent blood-vessels, which appear knotty, varicose, thick, and dark-coloured.

How a present scirrhus is to be known has been declared in the commentaries on §. 487; but to discover when a scirrhus inclines towards, or turns into, a cancer, we must attend to some new appearances which were not before observed. But a scirrhus never turns suddenly into a cancer; but degenerates by degrees, as it becomes more and more malignant. But those alterations by which a scirrhus advances towards a cancer, follow successively; and are here enumerated in that order in which they usually follow each other. An ulcerated cancer, or even an occult one inclining to be ulcerated, is well enough known to every body; but when a scirrhus first gives signs that it is about to degenerate towards a cancer, the knowledge thereof seems to be sometimes more difficult. This has been an observation made by Galen, who, in treating of this disorder, says, *When all the symptoms are indeed violent, no one will hesitate concerning the appellation, but every one will with a general consent name such a disorder a cancer. But it is reasonable to suppose that many of them as yet lie concealed in their beginning, in the same manner as plants sprouting up from the earth; for before these appear, they are not known to any body but the good farmers*^a. But as a scirrhus (§. 392) is defined a hard indolent tumour, the same name may be continued so long as there is no pain: but when a titillation or itching begins to arise, it is then about to degenerate from its inoffensive state (§. 488); though as yet it cannot be properly denominated a cancer, into which however it will be converted in a little time. But although there may be some room to doubt with regard to the denomination of this disorder, whilst it remains as it were in a state betwixt a scirrhus and a

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cancer;

^a Ubi magna quidem omnia sunt, nemo de appellatione ambigit, sed nominant communi assensu omnes ejusmodi affectum cancerum. Incipientem adhuc latere plurimos, consentaneum est, non secus quam e terra pullulantes stirpes; nam et hæc a bonis tantum agricolis cognoscuntur. *Alth. Med. lib. xiv. cap. 9. Charter. Tom. X. p. 329.*

cancer; yet this can occasion no error in the cure, since the same treatment is required both for an old scirrhus and an incipient cancer; namely, an extirpation, or the use of such remedies as are capable of removing the lately raised present symptoms, and prevent the future, so as to preserve the incurable disorder in the same state, and prevent it from degenerating into a worse condition. But that a scirrhus is about to turn into a cancer, is known from the following signs.

A titillation and itching.] This is more especially a sign much to be suspected in an old scirrhus, denoting that the nerves, dispersed through its substance, are gently stretched or irritated: but the itching being soon followed with pain, by the increased distension of the nerves threatening them with a rupture, (see §. 220), denotes that the scirrhus is now changed into a cancer. The danger of this symptom is the greater, as it compels the patient to scratch the itching part, even against his inclination: by which means the malignity of the degenerating scirrhus is increased; since any external irritation is sufficient to convert a scirrhus into a cancer, as was said before in the commentary, on §. 495. And as the ignorant common people have a general notion, that an itching in any diseased part is a most certain sign of an incipient healing, the patient is thence frequently rejoiced with false hopes, when at the same time the very worst of diseases, namely, a cancer, is threatened. Thus I saw a most impudent mountebank congratulate an unhappy woman upon her feeling an itching, after he had applied a plaister made of very heating ingredients to an irremovable scirrhus in her breast; which in a few weeks after broke out into a most malignant ulcerated cancer, eating through the whole breasts and all the circumjacent parts in a miserable manner. But as all prudent surgeons and physicians unanimously agree to pronounce these disorders incurable, the patient, however cautioned, is very apt to lend an ear to the vain boastings of these pretenders, who so impudently promise the cure which naturally is so much desired.

Heat and redness.] So long as a scirrhus remains

innocent

innocent or benign, it has the same colour with the rest of the adjacent skin, nor has it any greater heat; and therefore the appearance of a heat and redness may with good reason be feared. For it is a sign that an inflammation is then formed in the living vessels dispersed through the substance of a scirrhus, or at least that an inflammation is seated in the integuments of a scirrhus and adjacent parts: since it is evident, from what has been said in the commentary on §. 382, that heat and redness are justly enumerated among the effects of inflammation; and since, from an increase of heat and motion in the humours, a scirrhus turns into a cancer, as we observed in §. 495. But the danger is still more increased, inasmuch as the heat disposes every thing to a greater putrefaction, (§. 84, n° 5;) and we also observed at §. 85, that a putrefaction, once formed, occasions the sense of a troublesome heat. The perception therefore of heat in a scirrhus denotes, that a putrefaction is either already begun, or will soon follow; and is therefore always dangerous.

A shooting, pricking, or burning pain.] This sign; as we have often observed, distinguishes a cancer, even as yet occult, from a scirrhus. At first pains are felt, not continually, but at intervals, and soon disappearing, as if a sharp lancet was swiftly run through the scirrhus. It however frequently happens, that if the scirrhus is not irritated by perverse treatment, those shooting pains are not felt again for a long time, but the disorder lies dormant for many years after. But when these shooting pains return every day, and do not so soon disappear, there is great danger that the occult cancer will in a little time become ulcerated. But of all pains, that is the worst which seems to the patient like actual fire burning within the scirrhus; for then the integuments of the occult cancer are gradually distracted by the increasing of its bulk, and are corroded with a greater acrimony.

A reddish, deep red, purple, blue, livid, or black colour.] Various degrees of malignity are discovered in an occult cancer from the change of its colour; the least degree of which malignity is denoted by a faint red,

red, and the worst by a black, while the other changes of colour denote the intermediate degrees. For a reddish colour denotes a slight inflammation; a redness a more violent inflammation; but a purple the most violent of all, being as it were next to an incipient gangrene. But when the extenuated and eroded integuments begin to exhibit the colour of the subjacent cancer through them, there appears first a blue colour, inclining more to livid as the disorder increases; and when it is almost upon the point of breaking out into an ulcer, the cancer appears of a black colour through the yet thin skin by which it is confined.

Extreme hardness, inequality, roughness, and a protuberant point. So long as an occult cancer does not manifest itself by breaking thro' its integuments, it always feels very hard like a stone; and the greater this hardness is, so much the worse are all the symptoms to be expected. But when the cancer is once ulcerated, the contained matter, protuberating through the eroded integuments, does not appear so hard. But in these cases the surface of the tumour never appears equal, but always rough and knotty; while in that part, where the integuments are most distracted or eroded, there arises a protuberant apex from the less resistance in that part, which is a most certain sign that the cancer will be soon ulcerated; and afterwards it is usual for the integuments to break by degrees in that apex, as if they were excoriated; and this point is generally that in which the cancer first breaks or ulcerates.

An increase of the tumour.] A benign scirrhus often continues for many years without any remarkable increase of its bulk: but when it begins to be malignant, it frequently enlarges to more than four times its bulk within the space of a few weeks; and then we know for certain, that it inclines to an ulcerated cancer. But this never appears more evidently than when an irresolvable scirrhus, which has hitherto been dormant, is irritated by a perverse treatment.

The adjacent blood-vessels swelling, &c.] By this distension of the veins the cancer appears with a horrid

rid aspect; and from hence it is that this disorder first derived its name, inasmuch as the veins are extended from all sides of the cancer, like the claws of the crab-fish, as was said before in the commentary on §. 492. For while that tumour remains as yet confined within the integuments, yet increasing in bulk, it compresses the adjacent veins, which therefore become turgid and distended by the blood, which meets with the more difficult passage through them, whence they become varicose: and while the thinnest parts of the blood only are transmitted thro' the obstructed vessels, the remaining grosser parts will appear almost of a black colour. But it is constantly observed, that the veins of the skin are distended very much by the increase of any tumour. For instance, in dropsies, and in women with child, the veins of the distended skin of the abdomen are very much enlarged, and rendered varicose. But as these varicose veins are generally flattened by the pressure of the subjacent tumour, they appear still larger than if they retained their natural round figure. But the veins also appear knotty from the inequality or rough surface of the cancer, by which the veins are compressed more in some parts than in others. But from the dark, or black colour of these veins, the ancient physicians laid the fault of the disorder upon melancholy humours there accumulated: but it is evident enough from whence this proceeds, by what has been said before.

By these signs an occult cancer, seated in any of the external parts of the body, may be well enough known; but when it is concealed in some of the more internal parts, the discovery of it is much more difficult. But the nature of the part, with the preceding signs of a scirrhus, joined with a heat and pain where only a weight or sense of heaviness was formerly felt, may afford some light in these obscure cases.

Ætius describing a cancer in the breast not yet ulcerated, enumerates all these signs, when he says, *In a cancer therefore of the breast, which is not ulcerated, there appears a large tumour, resisting to the touch; unequal; almost like suet; obstinately fixed, extending its roots to a great*

great depth and breadth, and in a manner tied to the circumjacent veins, which have their varices round them of an asb-colour, inclining to red, and sometimes inclining to livid; seeming to the spectators indeed soft, but to those who touch it, it is extremely hard, insomuch that the sight is not to be trusted to in this part: but it occasions a pricking pain largely extending itself, insomuch that by consent it often excites malignant inflammation in the glands under the arm-pits. The pains also extend themselves to the clavicles and scapulæ ^b.

§. 498. **A**N ulcerated cancer is known from an occult cancer preceding (497): which is now opened; for the skin is then denuded from the parts as it were by excoriation, and a thin sharp ichor is expressed as if it transfused.

An ulcerated cancer differs from one not ulcerated, only in the corrosion of its integuments, which are broke open; and in its following after an occult cancer, as we said before at §. 494: whence it may be easily discovered; since it supposes first an occult cancer which is afterwards broke open. But the integuments are never broke through at one and the same time; nor is there a considerable quantity of collected humours discharged when the integuments break, as in an abscess, which being arrived to maturity breaks spontaneously: but the cuticle and skin are broken through gradually, as if it was by excoriation, and something of a thin ichor is expressed through the extenuated integuments; and thus they are torn off in thin

^b Cancro itaque non ulcerato in mamma existente, tumor apparet ingens, ad tactum renitens, inæqualis, instar feræ sævus, penitissime pertinaciter insertus, radices longe lateque extendens, et venis circumscissis velut illigatus, quas circumcirca varicosas habet, colore cinericius ad ruborem vergens, et aliquando sublividus. et videntibus quidem mollis apparet, tangentibus autem durissimus est, ut visui hac parte non sit credendum: dolorem autem inducit pungentem, late se extendentem, ut sæpe per consensum glandularum malignas inflammationes sub alis excitet. Pertingunt etiam dolores usque ad claviculam et scapulas. *Tetratib. IV. Serm. iv. cap. 43.*

thin scales, with extreme pain, till at length the substance of the cancer is forced gradually out of the aperture. But in what manner an ulcerated cancer passes through its various degrees of malignity, from the first time of its breaking until the death of the patient, is taught by the following aphorism.

§. 499. **T**HE progress of an ulcerated cancer is as follows: The sound or living vessels about the surface or edges of the hard cancer being distended and swelled into a tumour, and at length burst open by the impulse and attrition of the influent vital juices, from hence follows a putrefaction; and thence a subtile, acrid, fetid, and cadaverous sanies, or foul matter, corroding the ambient parts, and eating through those which are adjacent, spreading the disorder every way with deep malignant roots on all sides into the adjacent parts, in which it takes firm hold; the lips swell, and turn back in a frightful manner; an intolerable burning, pricking, or corroding pain is felt, the colour is like ashes, livid or black; and the disorder propagates occult cancers into the other glands; then follow hæmorrhages, convulsions, a slow fever, a wasting of the whole habit, the patient loses his smelling, indolent callosities arise in the ears, fainting fits succeed; and at length the patient, being wasted and worn out with these symptoms, yields to death.

The sound or living vessels about the margin of the cancer, &c.] It was said before, at §. 497, that an increase of the tumour, with extreme hardness, in a scirrhus, denoted it to be about to change into a cancer. The sound or living vessels, therefore, in the edges of the cancer, and even all round its surface, will suffer an attrition from it: and so will also those vessels by
which

which the vital juices are dispersed through the substance of a scirrhus, namely, those vessels which yet remain pervious; for all these being compressed on every side by the hard cancerous tumour, to which they belong, will suffer from thence a continual pressure and attrition. The inflammation hence arising, with its consequence, an increased velocity of the humours through the injured vessels, will still increase all these maladies. But from this continual attrition the vessels will be burst, and their contained humours will be extravasated, whence they will putrefy in a little time. But here can be no hopes of a mild suppuration, by which a separation may be procured of the dead and corrupted from the sound or living parts. This will be evident to one who considers what happens to a phlegmon tending to suppuration; and compares the same with the nature of a scirrhus, and of a cancer thence following. For, in an abscess, the ultimate and tender extremities of the small arterial vessels, being stopped up with concremented and irresolvable juices, are broken, or as it were cut off from their cohesion to the rest of the vessels, by the impulse of the arterial humours urging on the back of the obstructions: the open orifices of the vessels, from whence the obstructed ends were separated, do then discharge healthy juices, which, mixing together in a close and warm place, are in the space of a few days changed into good matter, which is discharged either spontaneously by a rupture, or by artificially opening the part. Thus nature conquering the disorder, as Galen^a well expresses it, pus or matter is formed, (see the commentaries on §. 387, 452); and thus a humour in its own nature apt to putrefy is reduced to such a change. For these extremities of the vessels, together with the obstructing and pervious juices, absorb as it were the sound humours, and are by them dissolved into uniform matter. But, in a scirrhus, the congealed humour often continues for years before it degenerates into a cancer; and at the same time it is also lodged in such parts as can receive little or none of the

^a De Febris, lib. i. cap. 7. Charter. Tom. VII. p. 114.

the impulse or efficacy of the arterial humours circulating; namely, in the cavities of the glands, or in the intricate ramous fabric into which the particular secreted humour is conveyed from the arterial blood. The obstinacy therefore of the matter, and the weakness of the force of the vital humours in a cancer, excludes all hopes of ever bringing the morbid matter to a laudable concoction, and therefore nothing but a malignant putrefaction can be expected. Galen^b very well observes, that a putrefaction arises on two accounts: either from the weakness of the concoctive faculty, which is not capable of performing a better change in putrefying humours; or else from the great malignity of the humours, which cannot be conquered by the concoctive faculty though strong. Now both these causes concur in a cancer: for the efficacy of the vital blood and humours, upon which Galen's concoctive faculty depends, is here little or nothing, or at most but very weak; whereas the malignity of the matter to be overcome by this weak faculty is very great. Those therefore delude the unfortunate patient with false hopes, who assert, that the matter of a cancer may be resolved and reduced into pus by suppurating remedies, however boasted or secret they may be. But is it not possible for a cancer to mortify, and then to separate spontaneously from the living parts by a suppuration formed round its surface, as happens in a gangrene or sphacelus? Certainly a person who could do this would be very happy, and deserve much from mankind. But that the hopes of effecting this are founded on little more than the shadow of a possibility, may appear from the great difficulties which oppose it. For the whole cancer is not dead, but receives vital humours through pervious vessels, and also contains living nerves in the middle of the corrupted and diseased part; of which we are assured from the severe pain, and the continual discharge of a great quantity of matter. But, in a gangrene and sphacelus, the parts being quite dead, are insensible of pain, even though they are destroyed by the knife or by fire; and they pass in-

to very dry crusts or eschars, as is evident in the histories of those disorders which we before gave. In a cancer, therefore, the dead and corrupted parts having as yet living nerves and vessels intermixed, excites by them those woful calamities which we shall hereafter enumerate. Nor does this disorder seem any way curable, unless those dead or corrupted parts can be removed, or the interposed living vessels destroyed without propagating the disorder into the adjacent parts: for if this last could be done, namely if the part could be deprived of all its vital influx and efflux of the humours, a gangrene or sphacelus would then follow in the room of a cancer; and the part affected would indeed perish, but then the progress of the disorder might be stopped, and a separation made of the corrupted from the sound parts. In the smallest cancers, the most powerful caustics, or even actual fire, destroying the disorder at one and the same instant, have sometimes made a cure in this manner. Thus the celebrated Boerhaave cured a certain divine of a small but malignant tumour in the external nose, by corroding the whole at one and the same instant with very strong oil of vitriol. For by that means is formed a dead crust, which, if so large as to contain the whole cancer, may be afterwards separated from the living parts by a mild suppuration. Celsus has very well remarked this use of corroding medicines, in a passage which we quoted before upon another occasion, in the commentary on §. 461, when he says, *For a crust follows under the corroding medicines; which, being separated on all sides from the living flesh, takes with it all that is corrupted; and the sinus, being now clean, may be cured with incarnatives*^c. But it is impossible to destroy larger cancers instantaneously in this manner by the action of the strongest corrosives, or even by actual fire itself, so as to convert them wholly into a dead eschar: But whatever part of the cancer remained not yet destroyed under this crust, would rage with ungovernable fury afterwards, tho' the

^c Sequitur enim sub medicamentis erodentibus crusta, quæ, undique a viva carne diducta, trahit secum quidquid corruptum erat; puraque jam sinus curari potest implentibus.

the part was ever so small. Hence little good can be hoped from this method, except in the smallest cancers; which yet might be more safely extirpated by the knife. Whether a remedy was ever known capable of restraining the spreading putrefaction of a cancer, so as to separate it from the living and sound parts, no one will pretend to say. We read in Herodotus^d, that Democedes, having cured a difficult luxation in the foot of king Darius, which was in vain attempted by the Egyptian physicians, made also a cure of an ulcer (*γύα*) in the breast of Atossa, daughter of the famous Cyrus, and wife to Darius: this ulcer breaking out afterwards, spread itself; which she concealed, through bashfulness, from Democedes, as long as it continued small; but when it grew worse, she made him acquainted with it. But there is no mention at all made in this cure either of the knife or cautery. Helmont^e relates, that a certain man cured every sort of cancer, by sprinkling on a powder which gave no pain, and at last healed the part with an incarnative emplaster. But he adds, that this art died together with the person. Whatever truth there may be in these accounts, there is no such remedy at present known, at least to the best of my intelligence.

Then a subtle, acrid, and fetid fancies, or foul matter, &c.] The dead mass in an ulcerated cancer exposed to the air, is by that, with the heat of the ambient living parts, in a little time converted into a horrid putrefaction, and dissolved into a most stinking matter. But the living vessels dispersed through the substance of a cancer, convey new juices, which are corrupted in a very short time by being brought to those parts which are already corrupted. The living nerves being extremely painful from their continual irritation by this acrid matter, do perhaps derive a larger quantity of a thin and acrid serum towards these parts: for it appears from what has been said in the commentaries on §. 163, that the tense nerves, tendons, or nervous membranes, being injured but by a slight puncture, produce the worst symptoms, and are

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^d Lib iii. p. 211.^e In capitulo *De Ideis Morbosis*, n^o 38. p. 437.

frequently accompanied with a profuse discharge of a thin acrid serum. It is therefore very probable that this cause also concurs in an ulcerated cancer, since there is often such a large quantity of the thin serum discharged from that disorder. But the juices brought to a cancer, seem to degenerate in the corrupt parts themselves; where they acquire that malignant and corroding nature, though they were very mild before. For I have seen, in women otherwise very healthy, that an ulcerated cancer has distilled such a very sharp matter: which therefore could not have pre-existed in the blood, but must have been generated in the diseased part. The great acrimony of this matter discharged from an ulcerated cancer is not immediately acquired: but the malignity gradually increases every day, as the putrefaction is increased. But we also see in other diseases, that the fluids in certain parts of the body, degenerating from their healthy disposition, do also corrupt the rest of the healthy juices with which they mix. After the extirpation of a breast, for instance, a large wound remains, in which physicians and surgeons have frequently lamented, that so large a quantity of humours is derived thither, and converted into laudable matter, that the whole body is thereby exhausted and dried up with a true marasmus. When the humours stagnate in the cavity of a fistulous ulcer, they degenerate from their mild nature, and never form there a white and uniform matter, but a sharp ichor or foul matter. When a fistulous ulcer, for example, remains after a caries in a bone, the nature of the matter contained in its cavity will be still more malignant. From all which it is evident, that the putrid mass of the cancer will convert the affluent humours into the like malignant nature, however healthy and mild they might naturally be of themselves. This seems to have been the opinion of Helmont when he says, *Matter and sanies are neither excrements of the ulcer or diseased part, nor of the natural digestion; but they are the products of the seeds or roots of the ulcer, &c. while in the ulcer dwells the proper corrupter, which vitiates the nutritious blood, before it can be fit to be digested,*

digested, &c. Sanies therefore, and matter, are not excrements of the ulcer, but the produce of that which corrupts them; and they are the fruits, effects, produce, signs, and marks of the blood being depraved into a noxious matter f. He afterwards draws many consequences from this opinion, and confirms the same with arguments; but what has been here cited is sufficient to demonstrate he was of opinion that the healthy humours derived to the ulcers, degenerated into the like malignant state with those which already stagnated in the bottom and lips of the ulcer.

But that the sanies or foul matter discharged from an ulcerated cancer may acquire a dreadful acrimony, is evident from the most certain observations. I have seen the linen which has been applied to a cancer, as much corroded with this matter, as if it had been touched with aqua-fortis. Hence Aetius justly pronounces: *But an ulcerated cancer continually corrodes, and eats deeply into the parts; nor can it be stopped, but discharges a sanies or foul matter worse than the poison of venomous creatures, of an abominable smell and quantity* g. No wonder then if this very sharp matter should corrode and eat away all the adjacent parts. I cannot without horror recollect myself to have seen an ulcerated cancer of the breast, which having eat through all the parts to the axilla, at length corroded the large vessels themselves, so that the patient was suddenly destroyed by a profuse hæmorrhage. Hildanus^h testifies; that in the space of four months time an ulcerated cancer eat through the whole breast and all the adjacent parts, even to the sternum and arm-pits. And Vanderwielⁱ has also observed an opening corroded

B b 3 in

f Sanies et pus non sunt ulceris aut partis excrementa, ut neque digestionis naturalis: sed sunt producta seminum sive radicum ulceris, &c. Dum in ulcere habitat proprius corruptor, qui cruorem alimentarium viat, antequam digeri sit aptus, &c. Sanies ergo et pus non sunt excrementa ulceris, sed producta corruptoris: suntque cruoris in noxiam materiam depravati indicia, signa, producta, effectus, sive fructus. *In capitulo, Scabies et Ulcera Scholarum, p. 258.*

g At vero ulceratus cancer assiduo erodit, et ad profundum perfodit, nec sisti potest, et saniem emittit omni ferarum veneno deteriorem, copia et odore abominabilem. *Tetralib. IV. Serm. iv. cap. 43.*

h Observat. Chirurg. cent. 3. obs. 87. p. 267. i Observat. Rarior. Centur. post. part. 1. obs. 26. Tom. II. p. 273.

in the stomach, to the size of one's fist, from a cancerous tumour. The lobe of the liver incumbent on the stomach, as also the adjacent diaphragm, were likewise eroded. And we also read of a perforation in the diaphragm, from a cancer in the pancreas; with a caries of the spina dorsa, and a total corruption or putrefaction of the kidneys*. Many such cases are to be met with in the writers of observations.

Spreading the disorder every way, &c.] If an ulcerated cancer could be eat away by this acrid matter just to the sound or living parts, as it would thus in a manner destroy itself, there might be some hopes of recovering the patient after so great calamities: but this terrible disorder converts all the adjacent parts into the like malignant state, first hardening them, and then eating them away by the spreading matter. And this happens not only in the circumference; but, the integuments of the cancer being broken, it penetrates deeply, and sends out its malignant roots, as they are called, by which it adheres firmly to the subjacent parts. For these indurated branches of the ulcerated cancer usually spread themselves every way; and the smallest part of any one of them being left behind after the extirpation of the cancer, will soon break out again, and renew the disorder with equal rage.

The lips swell, and turn back in a frightful manner.] When a scirrhus begins to change into a cancer, we observe an extreme hardness with an increase of the tumour, (see §. 497): but so soon as the integuments are eroded in that prominent apex which usually appears in a malignant scirrhus, there is a passage given for the substance of the cancer to expand or make its way through the opening; about the lips of which it is turned back, and increased into a livid fungus, sometimes almost of a black colour, composing the frightful lips of an ulcerated cancer.

An intolerable burning, pricking, or corroding pain.] For the skin being as yet entire, is by degrees broken by the swelling mass of the cancer; whence extreme pain follows from the slow distraction and laceration

ceration of the cutaneous nerves, continuing for a long time. Also the nerves dispersed through the surface of the cancer remain sensible, and are every moment corroded by the sharp acrid matter, which spreading through all the adjacent parts, eats them away. Therefore, from this continual distraction and slow erosion of the nerves, the patient will be continually tormented with severe pains, almost without any intermission. Hence therefore, it is evident, how much more severe a cancer is than a gangrene and sphacelus; since, in these last disorders, the parts being entirely destroyed by death, are not molested with any severe pains.

A cineritious, livid, or black colour.] When the flesh of the most healthy animal is suspended in a warm air, its red colour is soon changed into a pale ash, and from thence it inclines to livid as the putrefaction begins, and at length becomes quite black when it is dissolved into a putrid mass. The same changes of colour are also observed in the soft parts of the human body affected with a gangrene or sphacelus. Since, therefore, in an ulcerated cancer, the greatest part of it is mortified, and a putrefaction induced by the heat of the adjacent parts and free access of the air, it is thence evident how the colour comes to be thus changed according to the degree of corruption. And hence an ash-colour appears to be less malignant than a livid; and a black colour is the worst of all, since it denotes the greatest degree of putrefaction.

Communicating occult cancers to the other glands.] It appears from practical observations, that when some glands are disordered, others are likewise affected even in very distant parts. Thus we observed in the history of scirrhus tumours, that when the glands of the neck were scrophulous, those of the mesentery were likewise usually affected in the same manner; whence these may be justly called *communicating glands*. In an old scirrhus, and especially in a cancer of the breasts, the subaxillary glands are almost constantly indurated and swelled, so that by degrees they degenerate into occult cancers.

Hæmor-

Hæmorrhages.] To wit, when the blood-vessels dispersed through the substance of the cancer are dissolved, or when the large arterial trunks are corroded by the spreading disorder destroying all the adjacent parts. Thus a fatal hæmorrhage has been frequently observed to happen in a short space, when the axillary artery, or some of its most considerable branches, has been corroded by a spreading cancer of the breasts. And such a profusion of blood is extremely difficult to suppress, since a cancer is usually irritated and rendered much worse by any compressure or the application of styptic and acrid liquors. But a profuse hæmorrhage not only arises from the large adjacent vessels; but also the vessels themselves dispersed through the substance of the cancer are sometimes so much dilated, that even a division of them must be attended with great danger, though the same vessels were in their healthy state but very small. In that terrible cancer of the eye which we mentioned from the observations of Hildanus, in the commentaries on §. 495, there was discharged seventy ounces of blood in two days time by a rupture of the dilated vessels; and although the patient was much weakened by so considerable a loss of blood, yet, upon taking off the bandage next day, the blood started out with more violence than before. It sometimes happens, that women who are past child-bearing are afflicted with a continual fixed pain about the pubes, hips, and loins, after all the signs of a scirrhus in the uterus have preceded; and a sanious ichor is discharged from the pudenda: and in that case there frequently follows a most profuse bleeding from the uterus, by which the patient being much weakened, is for a time relieved, until her strength being recovered, all the same maladies return. In that case, the same cancerous disposition seems to take place in the uterus, which we observed before to have corroded the dilated vessels.

Convulsions.] Which usually denote either too great a profusion or loss of blood to have preceded, or else they follow from an irritation of the nerves and intolerable pain. See §. 226, 232.

Slow fever.] Arising from the continual watchings, and intense pain, with which the patient is molested. And, besides these, the acrid or putrid sanies which always covers the surface of the cancer, will be absorbed or insinuate itself through the mouths of the corroded veins, so as to infect the whole mass of blood with a putrid disposition; and from hence a cancer is reckoned among the particular causes of fevers, as may be seen at §. 586, n^o 5. Even if mild and laudable matter is too long confined in an abscess by entering the veins, it may very much disturb the whole habit (see §. 406), and much more will the absorption of the putrid or cancerous matter produce the same disturbance.

A wasting of the whole habit.] How much continual pains and cares of the mind are capable of extenuating the body, we are taught by daily observations. Since, therefore, patients afflicted with this disorder are continually tormented with pains, and alarmed by their foresight of the worst consequences, it is no wonder that they should waste away. And besides this, there is also a large quantity of the juices exhausted, while the ulcerated cancer continually discharges an acrimonious matter; in the mean time the body is preyed upon by a hectic fever, with continual watchings; and those functions which serve to restore the lost parts, by preparing laudable juices from the indigested aliments, are also at the same time depraved.

Loss of smell, with indolent callosities in the ears.] An ulcerated cancer usually diffuses an intolerable stench, which the by-standers are not capable of supporting; but in the mean time the patient is obliged to bear it day and night, from whence at length all the sense of smell is destroyed. Hippocrates enumerates this sign among the symptoms of a cancer, when he says, *And these patients are extenuated throughout the whole body; the nostrils are dry and drawn close, nor can they be dilated; the respiration is diminished, and they smell nothing; in the ears there is indeed no pain, but sometimes a callus arises in them*¹. I have frequently observed

¹ Ipsæque toto corpore extenuatæ sunt; nares siccæ et obductæ, neque

observed a loss of smelling in those afflicted with a cancer, but I never yet could meet with indolent callosities in the ears. Perhaps they may be incipient scirrhi of the follicles seated in the meatus auditorius.

Faintings, &c.] From the patient's strength being exhausted, either by hæmorrhage, pains, watchings, or a fever. And at length, after suffering the greatest miseries for a long time, death itself, which has been so often wished for, puts a period to all these direful maladies and torments.

From all that has been said before, it is evident how deplorable a disorder a cancer is, if it cannot be removed; as also how terrible its effects are, if it rages with incorrigible fury in the internal parts of the body: in which last case the only comfort to the patient is, that, by corroding the viscera, it sooner kills; whereas when the disorder is rooted in the external parts, it gradually corrodes them for whole months, or even years together. And it is also apparent with how much care a scirrhus ought to be treated, since it is the unhappy rudiments of an incipient cancer; and that it ought to be immediately extirpated, when there are no hopes of procuring a resolution, altho' it may seem innocent, and deceive the patient by its indolence.

§. 500. **I**N people of a good habit, an occult dormant cancer is easily supportable; but if it is provoked, or put into motion, we may foretel the raging evils before-mentioned (499).

In the prognosis, therefore, of this disorder, all the bad symptoms before enumerated may be feared; that is, in an ulcerated cancer: for so long as it remains yet latent or occult, confined within its integuments, so long it may be supportable, provided it is let alone, and not irritated by the application of remedies which increase the motion of the humours through the vessels
in

que elewantur; spiritus est imminutus, et nihil odorantur: in auribus dolor quidem nullus, sed interdum callus innascitur.

in the substance of the cancer itself; for by such means it will soon break out and rage. This has been very well observed by Celsus, who seems to have almost despaired of curing a cancer; and therefore he recommends only a palliative cure: *Nor was ever medicine found serviceable to a cancer: but if they were cauterized, they immediately raged and increased, till they killed the patient; and even if they have been extirpated, yet they returned again after the part has been healed or cicatrized, and occasioned the death of the patient: Whereas, In the mean time, those follow the best course, who use no force or violent remedy, in attempting the removal of this disorder; but only apply lenient medicines, which seem in a manner to soothe the disorder, and may render it supportable even to old age^a.* We are taught by practical observations, that occult cancers have continued for many years in the body without any notable injury. Tulpius^b relates that a woman sustained a hard and unequal cancer for above five and twenty years without any ulcer or other malady. But having occasion to be afflicted at some bad fortune of her husband, the hitherto silent malady awakened into an itching and pain, and, by the application of caustic remedies through the advice of some quack, it soon degenerated into an ulcerated cancer.

Hildanus^c has observed, in a woman of Lausanne, a cancerous tumour as large as a hen's egg, which had for many years grown about the left nipple. By the advice of some physician, *emplastrum de mucilagibus, de melliloto*, and the like, were applied in order by degrees to soften the tumour. But soon after the application of these, a pain and inflammation followed; which occasioned him to remove those plaisters, and apply coolers, by which the symptoms were quieted.

After-

▪ *Neque ulli unquam medicina profuit: sed adusta protinus concitata sunt, et increverunt, donec occiderent. Excisa etiam, post inductam cicatricem, tamen reverterunt, et causam mortis attulerunt: Cum interim plerique nullam vim adhibendo, qua tollere id malum tentent; sed imponendo tantum lenia medicamenta, quæ quasi blandiantur, quo minus ad ultimam senectutem perveniant, non prohibeantur. A Corn. Celsi Medic. lib. v. cap. 27. p. 318.*

^b Observ. Medic. lib. i. cap. 47. p. 90.
cent. i. obs. 89. p. 70.

^c Observ. Chirurg.

Afterwards the same plasters were applied again, but with the like ill success; and therefore they were afterwards rejected, and the patient survived a long time. In these cases therefore appears the truth of that aphorism of Hippocrates alleged in the commentary to §. 490, n^o 1. namely, That it is better not to cure those who have occult cancers; because they sooner perish by the treatment, whereas they survive a longer time if let alone. The truth of which axiom Hildanus proves by many instances ^d.

But it cannot be expected that an occult cancer will always lie dormant, unless the patient be of a good habit; that is, unless the blood and other humours have a mild balsamic disposition, like that which is always present in the most healthy people. For if any considerable cacochymy predominates, by which the humours degenerate from their natural state into a greater acrimony, as we observe in a sharp scurvy, and in a bilious, hot, or an atrabiliary habit; in that case an occult cancer will soon become ulcerated, as was said before in the commentaries on §. 495.

§. 501. **A** SMALL, incipient, moveable, or loose cancer, seated in a convenient part, and not adhering to any large vessels, arising from an external cause in a young and healthy body, and being the only one throughout the whole habit, is to be immediately extirpated by the knife, or else cut off.

Although, from what has been said before, it appears, that occult cancers may sometimes lie dormant for a considerable time; yet, as we observed of a scirrhus in the commentary on §. 489, there will be continual danger of its degenerating into a worse disorder, and this danger will be much greater in a latent cancer. And therefore it may be taken as a general rule in practice, That every cancer ought to be extirpated, if it can be done without destroying the patient, and with-

without danger of its returning. For although Celsus^e writes, that medicine was never of service in a cancer; yet we are taught by innumerable observations, that it may very often be safely and happily extirpated from the body. But, as we said before, he has given us a confused and obscure description of it; and if we also consider what he orders in the cure of a cancer, the reason will be very apparent why he unhappily succeeded: for he would have caustic medicines immediately applied; and if the disorder abated, and its symptoms lessened, he says that then the cure may be carried on by the knife and cautery. But it is evident enough, that, by this method, the cancer will be first much irritated, before advancing to the extirpation of it. If now we also consider what has been said by the other ancient physicians concerning the removal of a cancer, the reason will be still more evident why the worst consequences must necessarily follow from their practice. Thus we read in Ægineta^f, that some destroy all the vitiated parts with cauteries; and that others, extirpating the whole breast, afterwards cauterize: but he adds, that Galen recommends only amputation, by which the whole cancer may be cut off without leaving any root behind. Aetius^g, describing the operation for a cancer to Leonidas, says, that the cancer ought to be incised above the sound part of the breast, and the incised part to be burnt with cauteries, till a crust being formed, suppresses the hæmorrhage; and after this an incision is to be again made, and the cauterization repeated; and thus is the operation to be continued, by alternately cutting and burning, till the whole cancer is consumed: And then, after the amputation has been thus compleated, all the parts ought to be again cauterized till they are dry; and he adds, that the first cauterizations are made to stop the blood, and the latter to destroy all the relics of the disease. But he observes, that scirrhi may be removed only by incision: for he believed that in extirpating these there was no danger of a hæmorrhage, and there-

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^e Lib. v. cap. 27. p. 318.^f Lib. vi. cap. 45. p. 88.^g Tetrabib. IV. Serm. iv. cap. 45, 46 p. 981.

fore no necessity for cauterization. But how dangerous such a cruel method of curing a cancer must be, is evident enough; and even in the next aphorism it will appear, that convulsions are to be feared at that time when the ulcer is cleansed. But when a cancer is removed only by incision after the common method of the modern surgeons, the operation does not seem to be dangerous, provided the disorder is attended with the following circumstances.

Small.] For when the cancer is large, the operation will be more hazardous, and the wound greater; whence the cure must consequently be rendered difficult: for frequently a great quantity of matter being daily discharged, the patient's body will be exhausted and wasted with a true marasmus; or else, from the matter being left too long upon the surface of so large a wound, and absorbed or sent into blood, very often a purulent cacochymy will follow, to the destruction of the patient.

Incipient.] For the more inveterate the disorder, the event of the operation must be (*cæteris paribus*) less happy; since in that case there may be danger that some of the malignant roots of the cancer will remain fixed in the subjacent parts.

Loose or moveable.] For unless the whole cancer can be removed at one and the same time, the smallest relicks will sprout out more malignant than at first; but if the cancer is already rooted into the subjacent parts, it will be impossible totally to remove it. But in what manner it may be known whether a cancer is free from adhesions, was said before in the commentaries on §. 490, n^o 2.

Seated in a convenient part, and not adhering to any of the large vessels.] Of these we likewise treated in the place last cited, as also in the third number under the same aphorism: and in the same places it was also demonstrated how much might be expected from the dexterity of a skilful and intrepid surgeon, even in the most dangerous cases. For it was there shewn, that scirrhus parotid, submaxillary, and subaxillary glands, so much to be dreaded on account of their vicinity

cinity to large blood-vessels, were yet extirpated with the desired success by a prudent use of the knife. But doubtless, the worst consequences are to be feared, when the cancer adheres to large vessels; and yet, even in such a case, it seems eligible to try a doubtful remedy, provided there are but some hopes of freeing the patient from this worst of disorders.

[Arising from an external cause in a young and healthy person.] For when a scirrhus proceeds from a latent indisposition of the juices, and a cancer arises from that scirrhus, there is great danger, that, after the extirpation, the same cause continuing would renew the disorder elsewhere. But when a cancer arises, for example, from a contusion of the breasts, there will be no such danger of the disorder returning. And since the healing of the wound left after the extirpation requires a good state of health, it is sufficiently evident how much greater hopes there will be of a cure happily succeeding, when the operation is performed in a young and healthy person: for, in women past child-bearing, the habit naturally inclines to favour the production of a scirrhus and cancer (see §. 485, 495.) as also does an atrabiliary temperature.

[Being the only one in the whole body.] For we are taught by observations, that, after a cancer has been removed, if a scirrhus, though small, remains in any other part of the body, it would in a little time increase and change into a cancer. It ought therefore to be carefully observed, whether any thing of a latent scirrhus can be discovered in any other of the glandular parts of the body. For since it was made evident, in the history of a Scirrhus, that the like disorders might be also seated in the internal parts of the body, equal attention ought to be given to discover, whether any signs denote, that the internal parts are affected with a scirrhus or cancer. Thus, in those who have almost all the glands of their neck scrophulous, there is generally the like disorder seated also in the glands of the mesentery. And since there is a wonderful consent or communication betwixt the uterus and the breasts, it ought to be carefully observed, before the extirpation

of a cancerous breast is undertaken, whether any thing of the like disorder is to be suspected in the uterus. For if the patient feels an unusual weight about the hips or hypogastrium, or a troublesome pain invading the same parts, with the return at intervals of a profuse hæmorrhage from the uterus, or if something of an acrid sanies distils from the vagina, &c. there is great danger that a worse disorder will break out in the uterus, even though the extirpation of the breast be happily performed.

§. 502. **A**LL such medicines ought therefore to be avoided in the cure of a cancer, as are either emollient, emplastick, supplicative, acrid, excoriating, blistering, or caustic; for the application of these render the cancer ulcerated.

Many fatal events have sufficiently taught us, that a cancer, instead of being cured by the application of such remedies, has been always irritated and rendered more malignant; and therefore all prudent surgeons and physicians unanimously agree in prohibiting the use of such things. All emollient, and emplastick, and suppurative remedies, put the ungovernable matter of the cancer into motion, and dispose it to the worst putrefaction, but are never able to bring it to suppuration. Acrid and excoriating substances, with vesicatories, and actual or potential cauteries, dissolve the integuments of the occult cancer, and soon reduce it to an open or ulcerated state. See what has been said concerning the pernicious use of the like remedies in the commentaries on §. 490, n^o 3. and §. 495. It may be sufficient for us to produce one instance from Parey^a to confirm what has been here said. A noble virgin, who attended upon the queen dowager of France, had a tumour in her left breast equal to the size of a nut, the malignity of which was sufficiently apparent from the shooting pains. Parey judged that

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^a Livre vii. chap. 31. p. 184.

a palliative cure only was proper; to which opinion the expert physician who was consulted also gave his assent. After the disorder had continued in the same state for about two months, the patient being out of temper consulted another physician; who audaciously promised an entire cure, although he was told that the disorder had been judged by others to be incurable. He applied heating and emollient remedies to the tumour, from whence the breast swelled greatly in a little time, with most severe and violent inflammation, till at length the tumour broke, and at the same time a profuse hæmorrhage followed; which the physician endeavouring to suppress by the application of caustic powders, all the symptoms were in the mean time much irritated, and the patient soon after expired. How unhappy must be the person, who reflects, that he has knowingly with the like rashness precipitated the patient into the like dangers, upon the brink of which he stands!

§. 503. **A** LARGE, old, or adhering cancer, seated in a part unfit for extirpation, incumbent on or adhering to large vessels, and arising from an internal cause in an old cacochymical patient inclined to breed cancers, or having already other cancers in different parts of the body; under these conditions the cancer ought not to be touched, either by the knife (501), or by medicines (502).

In this aphorism are enumerated all those signs by which the extirpation of a cancer is prohibited; and which are directly opposite to those before enumerated at §. 501, and so may be easily understood from what has been there said. But a serious consideration of all the circumstances is necessary in those cases, where the extirpation of a cancer is meditated: for if a cancer is left, which is capable of being extirpated, the good of the patient is very badly consulted, and if a cancer is extirpated, which ought to be let alone, all the disor-

ders will be increased, and the unfortunate patient tormented with a severe operation to no purpose. When therefore the disorder is much to be feared, either from its immense bulk or long continuance, or else from its adhering to the adjacent parts, there is scarce any reason to expect success from the operation; and it is sufficiently evident, that the operation itself must be quite impracticable, unless a free access can be admitted to the hands and instruments of the surgeon. But when the vicinity of large vessels demonstrates that this operation will be dangerous, it ought not to be attempted, unless the surgeon is assured he can be able to suppress the hæmorrhage either by ligature or some other method. But it is evident, from what has been said in the commentary on §. 501, that a cancer arising from internal causes can hardly ever be extirpated with hopes of success; and this more especially if old age, or a considerable indisposition of the patient's juices, denote that it will be difficult to heal the wound left after the operation: For, as was observed in the history of Wounds, the restitution of the lost substance, and the union of the divided parts, require healthy humours to be conveyed with a due force and in a due quantity through healthy vessels. But when there are several scirrhi or occult cancers in parts remote from each other, we know that the body is disposed to generate cancers; and that therefore it would be useless to attempt the extirpation of a disorder, which appears to be germinating in other parts that will shortly be changed into the like malignity. In the mean time it must be confessed, that sometimes a cancer may be extirpated by prudent advice, even though there are some signs which would incline one to think that the operation must be either dangerous or useless. For the severity of this distemper is such as renders a doubtful remedy preferable to so certain and horrid a fate, provided there is but the least prospect of success; or even if only a respite can be procured, after the extirpation has been made, so as that the disorder may be prevented for any considerable time from appearing in other

other parts. But all these dangers ought to be proposed to the patient and his friends; that they may not be ignorant of the bad consequences to be feared, nor seem to have been deceived by the physician. Thus it was said in the history of a Scirrhus, that sometimes the extirpation of them was happily performed, even though the operation was extremely dangerous from the vicinity of the large vessels. Hildanus extirpated a breast, although there were several small scirrhi in the axilla of the same side, which he also removed at the same time, as we are told in his observations. It is the part of an honest physician to advise the patient to nothing but what he would chuse to have done to his own body if it was afflicted with the like disorder. When therefore, from duly considering every thing, it appears that the extirpation of a cancer is impracticable, or will be quite useless; nothing more can be done than to retain the incurable disorder in the same condition, and to mitigate the symptoms. But in what manner, or by what remedies, this may be performed, will be declared in the aphorisms following.

§. 504. **F**OR unless the cancer can be extirpated entirely, both with its roots and seeds, it will be exasperated, and return to the more internal parts, so as to produce other cancers, or increase those which are already formed.

That is called the *root* of a cancer, by which it adheres to the circumjacent parts, and as it were disperses itself through them. For it was observed before, at §. 499, that an ulcerated cancer sent out such malignant roots on all sides into the adjacent parts, by which it firmly adhered. The name of *roots* is not improperly given to these spreading parts of the cancer; because after it has been extirpated, it sprouts up again from those roots, if any of them are left. Hildanus^a relates, that when he examined a scirrhus tumour of the tongue by the touch, he observed branches like large threads dispersed from the scirrhus through the sub-

^a Cent. 3. obs. 84. p. 264.

substance of the tongue. Unless therefore a cancer can be extirpated together with its roots, the same disorder will grow up again in a little time. Ruysch^b relates a very desperate method of cure in this manner, in which after incision the part was cauterized with a red hot iron to destroy entirely the roots of the cancer. An old woman had for a long time a malignant and hard tumour in her tongue; and after she had had it several times cut out, it returned again; in this case, it was concluded by the advice of the celebrated Ruysch, that there was no other remedy remaining than to extirpate the returning disorder, and then to cauterize the part with a hot iron. The courageous old woman readily submitted to this severe operation, and boldly sustained it, hardly so much as crying in the midst of these torments, even tho' the cauteries were applied very hot, and several times repeated. After the eschars were separated, the part was soon brought to cicatrize and heal, and she afterwards survived a long time in health.

But the *seeds* of a cancer are properly those causes which laid the first rudiments of the disorder; whether that was a suppression of the menstrual or hæmorrhoidal flux, an atrabiliary temperature, a sorrowful life, or an hereditary disposition, &c. from whence a scirrhus might first arise and afterwards degenerate into a cancer: for unless these vices can be corrected, in vain will the cancer be extirpated, since the same causes remaining may give just reason to suspect, that the like disorder will break out in other parts, or even perhaps lay the rudiments of a scirrhus in some of the internal parts. But if, under these circumstances, there are scirrhi in other parts; after the cancer is removed, they will be soon increased, and degenerate into the like malignity, as we are assured from numberless observations. Tulpius^c observed in the dead body of a girl, who was suffocated by scirrhus strumæ of the neck in the public hospital, that under each struma were concealed others still smaller, not single, but several

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^b Observat. Anat. Chirurg. n^o 76. p. 70.
lib. i. cap. 46. p. 88.

^c Observat. Med.

ral lying near together in the same place, much in the shape of the seeds of lupines. But the latent seeds of the strumæ were disposed in such order, that the larger lay always over the smaller; and they gradually decreased in bulk inward, till at length they were hardly equal to the size of sesamum seeds.

§. 505. **T**HE cause of the cancer ought to be removed together with it, or rather before the cancer is extirpated.

But unless the cancer can be entirely extirpated, it ought rather to be let alone.

But a cancer of the uterus, fauces, palate, arm-pits, and groins, is incurable; and a cancer of the lips is very difficult to cure.

The cause of the cancer, &c.] The reason of which is evident from what was said under the preceding aphorism. But it must be certainly the best method, provided the raging disorder will admit of any delay, to remove first the cause of the cancer by suitable means, before the extirpation is performed.

Unless the cancer can be entirely extirpated.] For certain it is, that the remains of the extirpated cancer, however small, will in a short time grow to as large or even a greater bulk and malignity. The celebrated Boerhaave saw a remarkable instance of this in a certain lady, whose cancerous breast was extirpated by a very expert surgeon: after the operation was performed, there appeared an ash-coloured spot, hardly equal in size to the nail of one's little finger, in the midst of the wound; and as this penetrated into the pectoral muscle itself, the surgeon durst not cut down to its bottom, but hoped he might be able to remove it by caustics. The cure of the wound went forward happily enough, and almost the whole surface of it was now cicatrized; when the ash-coloured spot in the midst began to increase in bulk, and expand into a fungous mass, which, raging with the greatest malignity, eat through all the adjacent parts, till at length it destroyed

ed the unfortunate patient. In another case of the like nature, the surgeon, being more bold, extirpated the remaining root of the cancer, together with part of the living flesh of the pectoral muscle; and when every thing seemed to be in a fair way, on the fourteenth day after the extirpation, the patient's jaws began to be clinched, and were at length pressed so close together by the convulsive cramp of the muscles, that they could by no force be opened, and the patient expired in that species of convulsions called *tetanus*. From these cases it is evident how careful an examination ought to be first made, whether the cancer is on all sides free from adhering to any of the adjacent parts.

In certain parts of the body, cancers which thus arise, are either extremely difficult, or else quite impossible to be cured. If a cancer is seated in any of the viscera, it must be evidently incurable, since it is not accessible to the hand of the surgeon. Cancers of the uterus are also esteemed incurable, especially when they are ulcerated; but a scirrhus tumour inclining to a cancerous malignity, has been extirpated even in this part, as we related before from the observations of Tulpius, in the commentaries on §. 484. But it is believed no one will attempt to meddle with an ulcerated cancer in this part, which has already spread its malignant roots on all sides, as the same author observed in the body of a woman killed by a severe cancer of the uterus^a; for a livid and black tumour, spread on all sides with blood and matter, was every way firmly connected by membranous filaments to the uterus. Aretæus, treating on diseases of the uterus, speaks also concerning a cancerous ulcer in that part; and observes that it kills the patient, but first afflicts her for a considerable time. *For a putrid matter flows from the ulcer, which is not tolerable even to the patients themselves, and becomes exasperated by any kind of remedies*^b. From whence it is sufficiently evident that he here de-

^a Tulpii Observ. Med. lib. iii. cap. 34.

^b Putredo enim ab ulcere fluit, nequidem ipsis ægrotis tolerabilis, et quovis remediorum genere exasperatur. *De Caus. et Sign. Morbor. Diuturn. lib. ii. cap. 11. p. 64.*

scribes a true cancer of the uterus; although he sub-joins a little after, *But a cancer is by no means an ulcer, but a hard unconquerable tumour, which distends the whole uterus*^c. For he here seems to speak of a latent or occult cancer; having described the ulcerated cancer under the name of a *malignant and eating ulcer*: which is still more evident, because he adds immediately afterwards; *But both of these disorders are cancerous, of long duration, and pernicious in their effects; but before the ulceration, it is much worse, both in the smell of the matter, in the pains, and in the living and dead parts*^d.

[Fauces.] It was said in the commentaries to §. 484, that the seat of a scirrhus was frequently in those mucous follicles which lie in every part of the surface of the internal mouth, fauces, and pharynx; and this more especially because those follicles separate and collect a viscid mucus from the blood in its own nature much inclined to inspissate. Also the very numerous nervous papillæ, which are dispersed through these parts, do sometimes degenerate into a malignant cancerous fungus, as was said before in the commentaries to §. 496. Then I saw a large part of the palate, and the whole velum pendulum of the palate, cancerous in an old man; who after the greatest miseries perished of the disorder. When once the cancer has spread its roots deeply into the fauces, it is very evident that the disorder must be incurable: but when it has occupied only a small part, it may perhaps be removed by prudence and art. In Hippocrates^e we read of a cancer in the fauces cured by cauterization.

[Of the palate.] The hard and callous membrane which invests the bones of the palate, as was said before, does sometimes degenerate into a cancer, which is almost constantly incurable, unless it be very small. The difficulty of the cure is here still more increased, inasmuch as, when this membrane is corroded or destroyed,

^c At cancer neutiquam ulcus est, sed tumor durus indomitus, qui ens totum uterum distendit. *Ibid.*

^d Utraque autem hæc cancerosa sunt, et diuturna, et perniciofa: Ulcus autem non ulcerato multo pejus est, et odore, et doloribus, et vita et mortu. *Ibid.*

^e Epidem. vii. text. 129. Charter. Tom. IX. p. 596.

stroyed, the naked bones of the palate are also corrupted; from whence again the worst maladies follow. Hence Galen, explaining that aphorism of Hippocrates which prohibits the cure of occult cancers, says, *Any one who cauterizes or incises a cancer seated in the palate, anus, or sinus of the pudendum muliebre, will never be able to reduce the ulcer to heal or cicatrize, but the patient will be exhausted even unto death by the torments of the cure: whereas those who are not treated for a cure, live longer and with less uneasiness* f.

Of the arm-pits and groins.] The vicinity of very large vessels renders the extirpation of a cancer almost impossible without a fatal hæmorrhage. We observed, in the history of the scirrhus, that Hildanus happily extirpated one which was beginning to be malignant in the arm-pit. But when a scirrhus has once degenerated into a cancer, and especially an ulcerated one, it is evident enough that the extirpation must be extremely dangerous, since the vessels surrounding are varicose, and since there is great danger of its adhering to the subjacent vessels. Add to this, that the infection is frequently communicated to the subjacent glands, whence there will be great danger of the disorder breaking out again after the hazardous operation has been performed.

Of the lips, is very difficult to cure.] A malady too frequent, when the lips are injured by biting, so as to contuse those round glandular corpuscles dispersed through their substance; from whence very frequently arise scirrhi, degenerating into malignant cancers. And the like disorder also follows from an excoriation of the thin skin with which the lips are covered, whence the nervous fabric or papillæ of the lips degenerate or rise up into cancerous excrescences. When therefore the first attack of this disorder is observed, it ought to be immediately extirpated, either by the knife, which is the most safe method; or else by cor-
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f Qui cancerum in palato ortum, vel in sede, aut in sinu muliebri, fecerunt, aut ulserunt, non potuerunt ulcera ad cicatricem perducere; sed homines curationis cruciatu ad mortem usque consumserunt, qui non curati minori cum molestia diutius vixissent. In Comment. Aphor. 38. sect. 6. Charter. Tom. IX. p. 272.

roding medicines, which sometimes succeed in removing these small cancers. For when a cancer of the lips has not yet grown to any considerable bulk, it may be safely enough removed: whereas, if it was neglected, the spreading disorder would eat through the whole lip and adjacent parts; and then it could not be removed but with the greatest danger, besides the great deformity that would be left after the extirpation. It is almost incredible what large cancers have been sometimes extirpated from the lips by skilful surgeons, and which have been happily cured without any great deformity. I thus saw a man who had two thirds of his lower lip removed for this disorder; and yet so great a wound was closed with a very slightly cicatrix. In another, who would not permit the necessary extirpation, I saw the whole skin eat away by degrees before death.

§. 506. **I**F therefore the cancer is circumstanced as before-mentioned (§. 503), we ought to aim at two things: 1. First to keep the disorder quiet; and, 2. To mitigate the symptoms.

When therefore a cancer is discovered by the signs enumerated at §. 497, and which cannot be corrected or removed either by medicines or by the knife, the patient is in a lamentable condition, as entertaining an enemy in the body, which may be easily irritated, so as to rage with ungovernable fury, even from causes which are no ways avoidable by the greatest prudence. This fatal prognosis is to be by no means revealed to the patients, but to their friends only; for the patients ought rather to be fed up with hopes that the disorder may be sometimes bore without great calamities, by a prudent conduct, as long as they live. For, as Galen^a very well observes in his commentary on that aphorism of Hippocrates which prohibits the cure of an occult cancer, we are not to abstain from that treatment which quiets the cancer, and mitigates the symptoms, but only from such things as irritate. All the

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^a Commentar. in Aphor. 38. sect. vi. Charter. Tom. IX. p. 272.

hopes in this case consists in rendering the disorder sup-
portable, and in preventing it from becoming more
malignant; and at the same time to abate the symp-
toms, which are chiefly the itching, heat, and pain.
But in what manner, and by what remedies, this is to
be performed, is declared in the following aphorisms:

§. 507. **T**HE cancer is kept quiet or dormant
1. By defending the part from all
external injuries, by saturnine and narcotic medi-
cines. 2. By diminishing, correcting, and divert-
ing the known cause (495); to which conduce
lenient purges of the mild vegetable kind, with
mercurials given in small doses, and frequently re-
peated. 3. By diluent and mild aperient internal
medicines, with such as are neutral or alkaline.
4. And, lastly, by avoiding every thing, which
being taken internally, or applied externally, might
feed or support the causes of the disorder.

It was said before, in the commentaries on §. 492
that when the adjacent living vessels in the margin of
the hard scirrhus suffer an attrition from the increased
motion of the humours, thence an inflammation arises;
and the hitherto benign scirrhus changes into a can-
cer; and from what has been said in the commentary
on §. 499, it appears, that from the same cause the
malignity of a cancer is increased. But rest, or a se-
date motion of the humours, is here absolutely neces-
sary; not that absolute rest of the humours observed
in a dead body is here intended, but only that sedate
motion of them through the pervious vessels which
will give no irritation to the cancer, either from the
increased motion or acrimony.

1. How offensive any external irritation is to scir-
rhi, and cancers thence arising, has been said in the
commentaries on §. 495: All possible care ought there-
fore to be taken to defend the affected part more espe-
cially from the attrition of the clothes; and, as we
said

said before on §. 490, n^o 4. the utmost care should be taken not to let occult cancers of the breast be pressed by too tight lacing of the stays, or from violently exercising the subjacent pectoral muscles. Hence therefore the public charity can be never better bestowed, than in supporting those unhappy women who, being afflicted with latent cancers, are nevertheless under a necessity of getting their bread by manual labour. The best method of all is to defend the part with soft leather, to keep off all attrition from the incumbent clothes. Some emplasters are also recommended for the same use, but such only as are not too much emollient, or relaxing to the integuments, and which cannot offend by putting the matter of the cancer into motion. Here therefore the saturnine plasters only are convenient, and of these such as do not adhere very firmly to the parts to which they are applied: for otherwise there would be danger of confining the exhaling or perspirable matter by the tenacity of the emplaster, by which the integuments would be macerated, and inclined to break. It is also usual to join narcotics to these plasters, which by their efficacy allay those irritations to which the nerves are liable in their distribution through the cancer and its integuments, and by which the itching and pains so much to be feared are prevented and allayed. The emplastrum diapompholygos of the shops, prepared of the calces of lead, with oil of night-shade, is of very good use in these cases; and other forms of emplasters of this nature may be seen in the *Materia Medica* corresponding to this number of the present aphorism.

2. Since all the causes enumerated in §. 495 change a scirrhus into a cancer, if they are increased, or continue to act, they may also convert an occult cancer into an ulcerated one. These causes, therefore, discovered by their proper signs, ought to be removed, or at least to be mitigated; but if neither of these can be effected, the action of those causes ought to be diverted as much as possible. Nothing can be more injurious to a cancer than an acrimony of the humours, which soon causes a benign scirrhus to degenerate in-

to a cancer, as we observed before: Diligent inquiry ought therefore to be made whether any such acrimony is present, and of what nature it may be, that by proper remedies known to be opposite to the particular acrimony the same may be afterwards removed; for different remedies will be required according as the acrimony is either acid, muriatic, putrid, or rancid and oily, &c. In order to divert the morbid matter in the humours, purges are extremely serviceable, but of the milder kind, and such as evacuate or dissolve the humours without creating much disturbance in the body. Here the mildest mercurial preparations, mixed with such laxative purges, are highly recommended on account of the great dissolving power which they possess; always being careful to avoid raising a salivation by their imprudent use, which must be ever hurtful in these cases. If there are signs of a putrid state in the humours, as is frequently observed in the scurvy, a decoction of the leaves of senna, tamarinds, cream of tartar, and the like, may be serviceable: but then, to quiet the disturbance raised in the body even by these milder purges, it will be proper to give a mild opiate after the operation of the purge. But how serviceable purges are in preserving latent cancers from ulcerating, we are taught by Galen^a, who every year in the beginning of the spring purged a woman who had a cancerous disorder in her breast, with a medicine powerfully evacuating atrabilis: and he also observes, that if this purging was omitted, a deep pain followed, as a certain sign that the cancerous malignity then increased.

3. The whole design is to render the circulation of the humours sedate and equable: but this will be obtained by rendering the juices somewhat more dilute, and the vessels more pervious; such things therefore are to be given as dilute and attenuate, without increasing the motion of the humours. But water is almost the only diluent in nature, as we observed in the comment on §. 134; and to this are to be added such things

^a In Lib. *Quos decet purgare, et quibus catharticis, et quando.* Charter. Tom. X. p. 470.

things as attenuate, and at the same time mitigate the acrimony of the humours. Therefore decoctions of the roots of burdock, china, vipers grafs, farsaparrilla, grafs, &c. with infusions of agrimony, betony, mallow-flowers, and the flowers of mullein, elder-flowers, and wild poppies, &c. are of considerable use. For thus the blood is diluted, and the humours dissolved with medicines which gently attenuate and obtund or mitigate their acrimony; and at the same time their noxious parts are evacuated by urine or sweat. But as salts have the greatest reputation among attenuating remedies, and yet such as are more acrid are in this case inconvenient, only the milder subalcaline salts ought to be used, such as (for example) the nitre of stibium, the sal-polychrestum, in which the fixed nitre and alcali is inverted by the acid fumes of burning sulphur, in such a manner that it becomes less acrimonious, notwithstanding it yet in some measure retains its alkaline nature, whence these salts are usually termed subalcaline. But such salts are principally to be chosen, because alkaline salts obtunded with the oleous acid of rhenish wine, have been very often found serviceable in the cure of scirrhi. But as there is a numerous tribe of simples in the shops, whose attenuating powers are very well known, the forms of these remedies may be well enough varied, that the patient may not be tired out with the same remedy, when the curative indication still continues the same in this disorder.

4. An increased motion of the humours throughout the whole body or through the affected part, the acrimony of any humour, or any kind of irritation, were the principal causes which changed a scirrhus into a cancer, as was observed at §. 495. Every thing therefore of this nature, as well in the diet or regimen, as in the external or internal medicines, ought to be carefully avoided. And since an atrabiliary tenacity of the humours gives cause to the rise of scirrhi, and renders them malignant when once formed, as is evident from what was said before; therefore care must be particularly had, not to let any thing be taken in

the diet which may produce this effect, or increase the disorder when it is once produced. The diet must be therefore such as was described for an incurable scirrhus, §. 490, n^o 4. But as violent passions of the mind, and especially grief, are in these cases extremely pernicious (see §. 495), therefore the patients are to be fed up with hopes for the better, lest they should be overpowered with the fear of the imminent danger. If all these cautions are carefully observed, the threatening disorder may frequently be rendered supportable for years, and sometimes even to a considerable old age, until the patient is destroyed by a natural death, or by some other disease; and this is all that can be expected from art, so far as hitherto known, in this disorder.

§. 508. **T**HE symptoms are mitigated by the same means, (507); and the pain requires opiates.

For all the symptoms which accompany an occult cancer, result only from an increase of its malignity: if therefore, by the method described in the preceding aphorism, the cancer be retained in the same state, the present maladies will be mitigated, and the future prevented. The principal symptom is pain, from a distraction of the integuments by an increase of the tumour, or else from the acrimony of the cancer corroding the living nerves dispersed through its substance. It is frequently not in our power to remove the cause of pain; and therefore in that case nothing more can be done than to obtund the common sensory by the use of narcotics, so that although the cause of pain continues, the sense of it is removed, and some of its consequences, here to be feared, are prevented, (see the commentary to §. 229, n^o 2.). For unless this be done, watchings, restlessness, tossings, fever, &c. will follow (see §. 226), and in a little time all the maladies will be increased. See, concerning the use of narcotics, what has been said in the commentaries to §. 202, 229.

§. 509. **A**N ulcerated cancer (498, 499) if it cannot be extirpated, is often mitigated by keeping it clean, by applying mild saturnine remedies, and by the use of what has been directed before (§. 507, 508.)

When a cancer breaking through its integuments becomes ulcerated, it affords a lamentable sight to those concerned in the cure; and it is often so shocking, that I have seen intrepid and long-experienced surgeons scarce capable of inspecting the disorder with dry eyes. For the abominable smell and the curling back lips, together with the certain desperateness of the case, even move the compassion of those who in the most severe operations are not at all disturbed by the outcries of the patient. For although I believe every one would be willing to avoid being a spectator of these calamities, even if it was at some expence, yet common charity commands us not to desert the patient, which would render them more miserable, but to use our endeavours at least to mitigate the incurable disorder.

The very sharp ichor, which becomes daily more malignant, and, as Aetius well expresses it (see §. 499), worse than the poison of venomous creatures, corrodes the painful surface of the cancer, if it be left remaining upon it for any time; and from thence spreading, it eats into all the adjacent parts. Hence therefore the affected part ought to be cleansed several times in a day, and all the adjacent parts defended with some very soft ointment or saturnine emplaster, that they may not be corroded by the spreading sanies or cancerous matter. The best method is to absorb the collected virus, four times at least in twenty-four hours, with soft pledgets gently warmed: and then to cover the whole surface of the ulcerated cancer with the like pledgets, slightly spread with unguentum nutritum composed of litharge dissolved in vinegar and mixed with oil; for dry pledgets, though they would very well imbibe the discharged ichor, would nevertheless adhere to the surface of the ulcer, so as to render

der the avulsion of them very painful. Thus the free access of the air is excluded, and the drying of the surface prevented, while at the same time the putrefaction is resisted by the power of the vinegar, and the acrimony of this last is mitigated by the addition of the lead. All fat substances are observed to be pernicious, inasmuch as they render the surface of the ulcer imperforable, and by that means prevent the free discharge of the matter. Over the forementioned pledges is afterwards applied emplastrum diapompholygos, having its surface cut full of holes to give a free discharge to the matter; and over these holes in the plaster is again applied scraped dry lint to imbibe the distilling ichor. This whole apparatus is finally retained by a very loose bandage; for a strong pressure would irritate the affected part, and immediately increase all the evils.

But since the worst kind of putrefaction usually accompanies an ulcerated cancer, this ought also to be remedied as much as possible. Vinegar, sea-salt, salgem, &c. do indeed powerfully restrain all putrefaction; but then an ulcerated cancer is very badly irritated by every thing that is acrid. Hildanus^a relates, that a surgeon having applied unguentum Ægyptiacum to correct the stench, and stop the luxuriant fungus of the cancer, the disorder was thereby so much irritated, that in a little time the whole breast was corroded even to the ribs. From whence it is evident, that the greatest prudence is here necessary. But every thing of this nature applied to an ulcerated cancer ought to be so much diluted as not to be offensive by their acrimony. Vinegar, diluted with twenty times as much water, with the addition of a few grains of salt, may be tolerable; and will be very serviceable, if at every dressing the whole surface of the cancer is moistened with it made warm. Spirit of sea-salt, which so effectually resists all putrefaction, will be here likewise of the greatest use; provided it is diluted with so much water, that the liquor being dropped into the eye will give no pain. I have been able,

^a Observat. Chirurg. cent. 3. obs. 86. p. 267.

by the use of this remedy, to keep an ulcerated cancer in the breast of a poor woman, who was otherwise healthy, from degenerating into a worse state for the space of fifteen months together; and even in the margins I observed some signs of suppuration, by which part of the fungous mass separated and cast off, the bottom appearing sufficiently clean. But the great hopes which I had conceived afterwards failed me: for the malignity of the disorder afterwards increasing, I was no longer able to keep under the putrefaction by this mild remedy, and to apply any thing more acrid immediately exasperated the disorder; so that this unfortunate patient at last perished, after she had been afflicted with an ulcerated cancer for the space of two years. Hildanus^b ingenuously confesses, that he was deluded with vain hopes, when, by treating an ulcerated cancer of the tongue with various remedies, they seemed to have so much success, as not only to daily mitigate the severe malady, but also, after a violent hæmorrhage and a copious discharge of a cadaverous foul matter, the whole tumour disappeared, and discharged a laudable matter like an ulcer which has no malignity; and the flesh grew up not livid, but red; so that the part seemed to be near upon cicatrizing, only a small fissure remaining. But when every thing seemed to be in such a fair way, a scrophulous tumour lodged under the lower jaw daily increased, and at length communicated its malignity to the tongue; which from thence swelled so much within the space of a few days, as not only filled the whole cavity of the mouth, but also projected beyond the teeth in such a frightful manner, that Hildanus observed the upper teeth meet together with the lower through the eroded substance of the tongue, a little before the death of the patient. These lamentable cases teach us how terrible a disorder an ulcerated cancer is, to rage in so dreadful a manner after every thing seemed to be in a fair way to a cure. But from hence perhaps may be deduced some hopes, that the separation of a cancer from the sound parts is not quite impossible, tho' we

are

are yet ignorant of the methods and remedies by which that may be done. How happy must be the person who shall discover this; and what punishment would he not deserve, if from the sordid views of gain he should conceal it when discovered!

To these remedies, which resist putrefaction, may be added with advantage such things as are capable of mitigating the burning pain by their narcotic power when externally applied: for which purpose Galen recommends the juice of night-shade; and others recommend the cicuta and phellandrium. Aegineta likewise orders the juice of night-shade to be applied to the affected part, by dipping into it a cloth several times folded together, in order to remove the pain in ulcerated cancers; and externally he orders soft wool to be applied, which has been moistened with the same juice, taking care that the dressings do not become dry. Various fomentations may be also prepared of the like ingredients, by infusing the leaves of hen-bane, hounds-tongue, and poppies, in water, with the addition of vinegar and salt, but in a small quantity, that by the acrimony of these the pains may not be increased, and the disorder exasperated, which is so easily irritable. For the same uses a few grains of opium are likewise added to such fomentations.

In the diet, only the most emollient pot-herbs, flesh-broths, and preparations with milk, are convenient; avoiding every thing difficult to digest, or capable of offending by its acrimony, as was said before at §. 507. A plentiful use of an infusion of elder and wild poppy flowers has been also found very serviceable.

§. 510. **T**HE extirpation is performed, 1. By purging the patient's body with a proper diet and restorative medicines opposite to the cause of the disorder. 2. By cutting out the whole cancer with its roots at one and the same time, elevating it first with a thread passed through by

^c Lib. ii. Method. Med. ad Glaucon, cap. 2. Charter. Tom. X. p. 390.

^d Lib. iv. cap. 26. p. 56.

the root, or with a small fork fixed into it, or else by dividing the integuments, and prudently separating the same. 3. The remaining wound is to be dressed seldom, and with a slack bandage; observing to let the blood flow freely from the adjacent parts, before the dressings are applied.

If an ulcerated cancer is seated in a part of the body accessible to the hand of the surgeon, not yet adhering to any of the adjacent parts, nor accompanied with other scirrhi elsewhere which cannot be removed, and when there is at the same time no reason to suspect the internal parts of the body to be infested with the like disorder; under these circumstances, the cancer is to be removed as soon as possible, lest, if it should be neglected longer, its malignity might increase and infect the adjacent glands. But the following particulars are necessary to be observed in the extirpation of a cancer.

1. Since this is often a severe or cruel operation, and the extirpated cancer sometimes leaves a large wound remaining, it will be adviseable first to fill the body with good nourishment and pleasant cordials, capable of recruiting, without exciting any great commotion in the blood, the patient's strength and vital faculties, which have been oppressed by the pain, fear, and watchings; for by this means we may afterwards expect a more happy consolidation of the wound. At the same time care must be taken, that the aliments and medicines may be such as are opposite to the known causes of the cancer. As if, for example, a benign scirrhus should be converted into an ulcerated cancer, from a putrid scurvy raging in the habit; in that case, all grain or pulse, with soft garden-fruits a little inclined to be acid, will be serviceable: But if an atrabiliary temperature attends, honey, and juices of the gramineous plants, will be convenient together with the former. But if there are signs denoting that an austere acid predominates in the body, flesh-broths, with things that are oily and emollient, &c. ought to be given: but since a cancer naturally inclines to the

worst

worst putrefaction, it is therefore usual to exhibit only acescent aliments in this disorder. But frequently the severity of the disorder urges, and will not admit of time to correct the known acrimony of the humours before the extirpation, since there would be danger of the ulcerated cancer infecting the adjacent parts, or spreading its malignant roots more deeply, so as to render the extirpation itself impracticable: and in such a case it is therefore best immediately to extirpate the cancer, and afterwards to correct the known indisposition of the humours by a suitable diet and remedies.

2. Celsus ^a gives so severe a prognosis in a cancer, that he admits it to be capable of little more than a palliative cure. For even if the cancer is extirpated, he says it returns and kills the patient. But it appears from innumerable observations, that if a cancer be removed altogether and at once, without leaving any of its roots, it may be safely extirpated without danger of its returning^b; but if so much as the smallest part is left behind, the cancer then returns more malignant than at first. But concerning the different methods proposed for the extirpation of a cancer, we treated before in the commentary on §. 490, n^o 2. concerning the extirpation of a scirrhus.

3. Since the adjacent blood-vessels round the cancer are swelled, and usually distended with thick and dark-coloured blood, (see §. 497.) it therefore seems adviseable, after extirpating the cancer, to suffer this blood to be discharged from the vessels, in which it has long stagnated, and not immediately to suppress the hæmorrhage: for there may be just grounds to fear lest this blood should have contracted some malignity from the adjacent cancer, from whence the like disorder might return in different parts of the body. It was said before, at §. 499, that an ulcerated cancer in communicating glands propagated the infection, and produced other latent cancers. Nor will it be much detrimental to the patient to lose a few ounces of blood in this manner. But Parey ^c, for the greater caution,

^a Lib. v. cap. 27. p. 318.
obs. 87. p. 270.

^b Hildan. Observ. Chirurg. cent. 3.

^c Livre vii chap. 31. p. 180.

caution, advises to press the distended veins on all sides, entirely to discharge the dark-coloured blood; and then he uses the actual cautery, partly to suppress the hæmorrhage, and partly to destroy any latent relics of the disorder that might yet remain. But this cruel method of suppressing the hæmorrhage by actual cauteries is grown into disuse, since this may be performed by more safe and gentle methods: and if the cancer has been entirely extirpated, there is no necessity to cauterize the recent wound to destroy the remains. Yet it was said before, in the commentary on §. 504, that Ruysch thus removed a cancer of the tongue which had returned again after extirpation; and that in this case the part was cauterized with good success.

After the cancer is removed, a large crude wound remains, provided the cancer itself was large, and extirpated together with all the integuments at one and the same time: but if the cancer was removed by enucleation, the wound will be less and sooner cured, as was said before in the history of a Scirrhus, §. 490, n° 2. Seldom dressing will be convenient, that the proper nourishment of the body may not be too much exhausted by the great discharge of matter, so as to destroy the patient with a marasmus; and at the same time care is to be taken that the matter be not left too long remaining upon the surface of the wound, so as to be absorbed by the small veins, and affect the blood with a purulent cacochymy, from whence again the worst consequences might follow. But as by this operation a large part of the body is removed, therefore every thing ought to be observed, which we mentioned as necessary in the cure of wounds with a loss of substance, at §. 189, *et seq.* But more especially a very soft absterision of the wound will be necessary whenever it is dressed, lest the tender pulp of the repullulating vessels should be destroyed by a greater violence, as we observed before in treating of the cure of wounds.

§. 511. **T**HESE being performed (510), the patient must continue a long time in the same diet and course of remedies as if the cancer still continued; and from what has been said, one may readily foresee the maladies which may proceed from a cancer seated in a part unfit for extirpation.

As nothing can give greater concern and uneasiness both to the surgeon and patient, than, after the performance of a severe operation, to be obliged to repeat it for a return of the disorder in other parts; therefore the same diet and course of medicines is to be still continued, as being apparently opposite to the causes of a cancer, and this more especially if the extirpated cancer arose from internal causes. For when a cancer arose from an external cause, as for instance from a contusion in a healthy body, there can be hardly any danger of its returning after extirpation. But at any rate, it is much better to exceed in these cautions, than to rely too much upon an insecure foundation; and at the same time there will be no difficulty in causing the patient who has once experienced this dreadful disorder, very strictly to observe the physician's orders. Every thing, therefore, which has been directed at §. 507, n^o 2, 3, 4. ought to be continued afterwards for a considerable time. But since it is evident from what has been said at §. 484, 496. that scirrhi and cancers have been sometimes found in the internal parts, it must be very apparent what dreadful maladies will follow when the viscera are corroded by the distilling matter of an ulcerated cancer. The greater part, and even the most obstinate, of chronical diseases, arise from scirrhus viscera; and it appears from practical observations, mentioned before in the history of Scirrhi and Cancers, that the most severe pains, surprising erosions of the viscera, and at length sudden death after the most severe torments, has been the consequence of a cancer eating away the internal parts of the body.

Of the DISEASES of the BONES.

§. 512. **T**HE bones also are subject to the same diseases with those which we have already described in the softer parts.

Before we treat of internal diseases, we have a chapter still remaining concerning the diseases of the bones; and the consideration of these will be greatly advantageous, as it will give us a better insight into many particulars which occur in the venereal disease, the rickets, and scurvy.

It may perhaps seem strange, that the bones, whose office it is to give stability and support to the other parts, and which are justly termed by Galen ^a the hardest, driest, and most earthy parts of animals, should be subject to resembling diseases with the softer parts; and yet the following observations will convince us, that no fact can be more strictly certain.

The bones originally were all of them soft; for in the first days after conception, the whole substance, from whence the man is to be formed, would fall together like a shapeless mucus, unless sustained by the uniform pressure of the ambient fluid. This is evident from the observations made by Malpighi in the generation of the chicken from the egg. So also, when the man is first brought into the world, many of the parts are found to be membranous and soft, which are afterwards changed into very solid bones. This is more particularly seen in the bones of the head, which retain the nature of a membrane a considerable time in that place upon the top of the head which is called the *fontanel*, and which in some persons continues soft and membranous till they are eight years old and upwards. And what is still more surprising, the teeth, which afterwards become so extremely hard, whilst they lie concealed in the jaws of a new-born infant have the resemblance of a soft mucus overspread by an

^a Libr. de Ossib. in Proœm. Charter. Tom. IV. p. 9.

immense multitude of little vessels. As therefore the bones have originally all been soft, they must have been liable to all the diseases incident to the soft parts, at least before they have grown hard. And even after they have acquired the solidity which is requisite to make them fit for the uses they are designed for in the human body, they are not so absolutely hard and dry as they appear to us to be in a skeleton, but are furnished with moisture, and supplied with a considerable number of vessels, which convey a liquid through the very substance of them, and carry it into their cavities. So that with regard both to these containing vessels, and to the fluids they contain, the very same disorders may all happen to the bones, which are incident to the softer parts; and at the same time the bones must evidently be more subject to these disorders at an age when they naturally approach nearest to the state of the soft parts, that is, in childhood, as we find by daily experience: And hence it comes to pass, as we shall see more plainly hereafter, that a spina ventosa seldom occurs but in young people. In very old age, indeed, the bones, being grown dry and void of moisture, are apt to be broken upon every slight occasion, but are less liable to be affected by other diseases.

We learn farther, from indubitable observation, that the bones may be so altered by disease, as to lay aside their natural solidity, and become as soft as flesh. M. Petit tells us ^b, that, upon opening an abscess near the articulation of the thigh with the hip, he found both the head of the os femoris, and the cavity of the os ischium, to resemble flesh in colour and consistence, but greatly increased in bulk, and so soft that they bled upon the slightest pressure. That ingenious gentleman farther adds, that he had frequently seen the bones changed into a like soft and fleshy substance. From whence it is plain enough, that the diseases of the soft parts may take place in the bones; and this will be farther confirmed from the discoveries made by anatomists in the structure of the bones.

^b Traite des Maladies des Os, Liv. I. chap. xi. p. 316.

§. 513. **F**OR the interstices of these are lined with a thin membrane, which is furnished with the same kind of vessels, and perpetually supplied with the same liquids, as the softer parts.

Those very eminent anatomists Dr Clopton Havers^a and Dominico Gagliardi^b have fully proved, that the human bones consist of lamellæ or thin plates lying one upon another, and yet not at all times and in all places so closely connected, but that they have vacuities interspersed between them, through which there passes a very considerable quantity of vessels. This is more remarkably conspicuous in the larger bones that are hollow, such as the os femoris, the os humeri, the tibia, &c. For in the middle of these bones these lamellæ appear to be most firmly united, and the texture of the bones is there found to be most compact; but, in passing from the middle of the bone towards the extremities on both sides, the internal lamellæ begin to be separated from those that lie upon them, and leave a considerable vacuity between. And the nearer we approach towards the extremity, the greater is the number of the lamellæ that are thus separated, till at last there shall be left only a very thin bony lamina, to cover and defend that surprising cellular substance which is found to lie near the extremities of the larger bones. For in proportion as these lamellæ recede from each other in the several parts of the cavity of the bone, this cavity grows less, till at length in the extremities it ceases to be, the whole vacuity being entirely filled up with the cellular bony substance. In all places also between the receding bony lamellæ there arise thin portions of bone, which connect the divided lamellæ to each other, and keep them as it were in their due situation, at the same time subdividing the spaces that lie between them into cavities of a narrower compass. But in the lesser bones, which have no large cavity, as for instance in the bones of the fingers, the union and

Fig. 3. into c. &c. con-

connexion of the laminæ is not discernible in the middle, but several of the inner laminæ are divided from the outer ones the whole length of the bone, and form the like bony vacuities not only towards the extremities, as in the larger bones, but throughout every part. And for this reason these bones are much weaker than the others, as the strength of the bones depends upon the union and connexion of a great number of these bony lamellæ. The like bony lamellæ are found in the cranium, which, lying one upon another, constitute the substance of the skull, and in some skulls the spaces which lie between them are plainly to be discerned.

The vacuities left between these receding lamellæ are lined with their proper membranes, which are furnished with a considerable number of vessels. This we learn from the injections of Ruysch, and may farther see in the larger bones of animals that are fresh killed, without any precaution at all: so that it is by no means extraordinary that the bones should be subject to the like diseases with the softer parts, as they are supplied with a like kind of vessels and resembling liquids.

This structure of the bones, from lamellæ lying upon each other, corresponds exactly with the observations which occur sometimes in diseases. It was observed, in the account of Wounds in the Head, §. 249, That if the pericranium was injured, so as to leave the bone naked for any length of time, it would change its colour, and the corrupted scale at last be separated from the sound bone which lay underneath it; as also, in §. 252, That when the part affected in the bone is perforated by a very small terebra, the vessels lying underneath, wherein there is life, shall find for themselves a passage through the little apertures that are made by the instrument, separate the corrupted part, again supply the lost substance of the bone, and form a new periosteum, in like manner as the substance lost by a wound is renewed in the softer parts. It appeared farther from the observations recited there, that this may be brought about without perforating the affected part quite thro' to the diploë, (for nobody will deny there are

are vessels there); but that in small disorders a very slight terebration will suffice, and yet that in this case the vessels also will pass through the apertures. It is plain therefore, that there are vessels which pass between the lamellæ of the bones of the skull, and which are capable of safely emerging in due season from under the covering of the corrupted bone. Celsus, treating of the cure of faulty bones, long ago observed, *That it is before all things necessary to lay bare the bone; and, if the foulness of the bone extend farther than the ulcer, to cut away the flesh, till you come to the sound part of the bone: and then it will be adviseable to free it from whatever fat substance shall lie about it, by the application of the actual cautery; and to repeat it if needful, so as to cause an exfoliation; or to rasp it, till the blood begins to shew itself, which is the distinguishing mark of a sound bone, for whatever is foul cannot but be dry and bloodless^c.*

§. 514. **A**ND in proportion as these vacuities are greater, by so much the nearer does the bone approach to the structure of a soft part.

For as these vacuities, that are left between the divided lamellæ, are supplied with membranes that are sprinkled over with vessels, the larger these vacuities are, the greater number of vessels they will have, and consequently the bone in that part will approach very nearly to the structure of the soft parts.

§. 515. **A**ND consequently will be more liable there to those diseases, which are otherwise judged to be incident to the soft parts.

This is evident enough from what has gone before.

For

^c Oportet autem ante omnia os nudare, ulcere exciso; et si latius est ejus vitium, quam ulcus fuit, carnem subsecare, donec undique os integrum patefaciat: tum id, quod pingue est, semel iterumve satis est admo- to ferramento adurere, ut ex eo squama secedat: aut radere, donec jam aliquid cruoris ostendatur, quæ integre ossis nota est; nam necesse est aridum sit id, quod viciatum est. *Lib. viii. cap. 2. p. 508.*

For as there are vessels and humours here, in like manner as in the soft parts properly so called, whatever has been already observed concerning the too little or too great strength of the vessels, as also the several spontaneous degenerations of the humours, must likewise take place here. The motion also of the humours through those vessels may be too quick or too slow. And for the same reason there may be an obstruction, a solution of continuity, an inflammation, and all the consequences of it, in the bones, in like manner as in the soft parts.

§. 516. PARTICULARLY in the broader part near the joints, as the middle of the bone is more compact, and less vascular.

We have already observed in the commentaries on §. 513, that the lamellæ, whereof the larger bones of the body are composed, are so very compactly joined in the midst of the bone, as to leave scarce any vacuities between them; and for this reason the bone is both most solid in that part, and at the same time either very few and very small vessels, or none at all, are capable of passing between them. But as these lamellæ gradually recede to a greater distance from each other towards the extremities, and have the intermediate spaces lying between them gradually increased, the bone will not only grow broader near the joints, but will also become weaker, and more susceptible of injury, as the external bony covering, composed of the united lamellæ, will there be the thinnest. Dr Havers^a tells us, that in an os femoris he had seen the sides in the middle of the bones, before any of the lamellæ were parted off, five times thicker than in the head of the same bone. But in a like os femoris, which I have by me curiously prepared, the sides in the middle are at least twenty times thicker than the thin covering, which is spread over the head of the bone, the bigger trochanter, and the lower part of it that is articulated with the tibia. And thus the reason

^a Osteol. Nov. p. 39.

son is very evident, why these parts of the bone which lie near the joints, are most frequently subject to the like diseases with the softer parts. And for the same reason much worse consequences are apprehended in fractures, if they happen in the broader part of the bone nearer the joints, from the many vessels that are injured, and the effusion and corruption of the liquids, as was observed in the commentaries on §. 342, 343. But a greater degree of firmness was required in the middle of the bone, than towards the extremities; because, for instance, whilst the whole weight of the body is supported by the os femoris, the greatest force acts upon the middle of the bone. And at the same time as the cavity is formed for the reception of the marrow by the very close union of the lamellæ, the strength of the bone is withal consulted. For it is demonstrated by the ^b mathematicians, that a hollow cylinder is not so easily broken, as one that is solid, which contains a like quantity of matter.

§. 517. **H**ENCE (514, 515, 516) the first distinction of diseases in the bones.

To give a distinct account of the diseases of the bones, it will be necessary to throw them into certain classes, according as the several parts are affected, which constitute the fabric of bones; for the effects of these diseases will be entirely different, and a different method of cure required, in proportion as the different parts are affected. And the first division of these diseases is drawn from the place where they lie, for instance, in the larger articulated bones; as whether they are seated in the middle and most solid part of the bone, or near the extremities, where the bones are thicker indeed, but less compact, and of a cellular contexture.

§. 518. **T**HE bones, besides the vessels which they have in common with the softer

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er parts, have also in their wider cells vesicles filled with a subtile medullary oil, which is there secreted and reserved for its proper uses; these vesicles, which are largest near the joints, gradually sink into the substance of the bone, and being converted into very narrow pinguiferous canals, become scarce visible.

As therefore, in the broader part near the joint, the fabric of the bones approaches nearest to the structure of the soft parts, they will in that part more particularly be liable to all the diseases observed in the softer parts. But there is another circumstance attending upon the bones, which frequently gives rise to the worst diseases they are capable of suffering. For in this cellular part of the bones there lies a very subtile medullary oil, that is separated from the arterial blood, and collected into vesicles, which both communicate with each other, and the whole medullary system repositied in the larger cavity of the bones, and transmit it also through the pores of the cartilages, which cover the extremities of the articulated bones, into the cavities of the joints, so as, by intermixing it with the glutinous humour that is separated from the glands which are seated here, to form a liniment for the lubrication of the moveable joints. See the commentary on §. 362. These medullary vesicles, being also placed between the seceding bony lamellæ, seem farther to impart a portion of their medullary oil to these bony lamellæ, in order to keep them from being too brittle. For, as we shall see by and by in the commentary on §. 524, the medullary oil enters the pores of the bone in those places where the lamellæ are most closely united, and is distributed into the spaces that lie betwixt them; as in the most solid and middle part of the bones there is no room found between the lamellæ for the medullary vesicles. The medullary oil, therefore, contained in the vesicles which are found in the cellular part of the bones, seems to have a twofold use; namely, to lubricate the joints; and to diffuse

fuse itself between the lamellæ, in order to keep the bones from being too dry. For which reasons, if either through diseases, or old age, this oil should chance to fail, the joints are moved with difficulty, and grow apt to crackle; and the bones, being no longer lubricated by it, become more liable to be broken by every slight injury.

How great the quantity of the medullary oil is, which lies in this cavernous part of the bones, may be gathered from what we observe in the marrow-bones of oxen when they are boiled. For after all the marrow contained in the larger cavity of these bones shall be taken out, if their extremities be divided, or even broken with a hammer, a very large quantity of a thin medullary oil shall likewise distil from them. We shall treat hereafter of the structure of these vesicles, which contain the medullary oil, under §. 524. as they are exactly similar to those which form the marrow that is found in the middle cavity of the larger bones; the only difference being, that in the cavernous part of the bones there are only a few of them to be found, and in the smaller channels it may be only one; the marrow itself being no more than a congeries of several such vesicles, comprehended under one common membrane. Where therefore the distance between the seceding lamellæ of the bone is greater, therefore, it is plain, there is room for a greater number of these vesicles: but in the places where the lamellæ are either contiguous, or lie but at a little distance from each other, there can be none; and this subtle oil must be either conveyed between the lamellæ by very slender canals derived from these vesicles, or pass through the pores of the bony lamellæ themselves; of which more hereafter.

§. 519. **H**ENCE another class of diseases in the bones.

Hence another cause of diseases in the bones, proceeding from the state of the vesicles which contain the medullary oil; whence shall arise the very mischievous
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depravation of the oil itself, and many other disorders, whereof we shall give an account in §. 526.

§. 520. **A**LL the bones are surrounded and covered on their outward convex side with a periosteum, which conveys arterial vessels into the cells and marrow, and brings back an infinite number of veins both great and small.

Dr Havers has ^a shewn, that all the bones of the body are covered with a thin membrane, almost transparent, and very sensible, which consists of several strata of fibres, lying upon each other, but not interwoven. These fibres lie in a like direction with the length of the bone, and run parallel to each other. In some places this membrane seems thicker than in others, and to consist of fibres crossing each other in different order; but this arises from the muscles, or their tendons, which pass over the periosteum before they are inserted in the bones. He farther observes, that the periosteum leaves the bones in the places where the ligaments arise which fasten together such bones as are articulated, and, passing over them, proceeds to the bone adjoining, as we have observed also upon another occasion at §. 343. Whence he supposed, that the periosteum is no other than the continuation of one and the same membrane, which, rising from the dura mater, invests the cranium, and is thence extended over the surface of all the other bones. This membrane, spread over the bones, conforms itself exactly to their various cavities and protuberances, and so covers the surface of them entirely. That part, however, of the articulated bones, which lies within the ligaments that encompass the joint like a purse, has no periosteum; this membrane deserting the bones in these places, as we have just observed, and passing over the ligaments. Nothing therefore can be brought to the bones, or be carried back from them, but by means of the periosteum. All the arteries, therefore, which

^a Osteol. Nov. p. 14, &c.

which are conveyed to the bones for their nutrition and increase, or penetrate into their cellular part, or are carried through distinct foramina to the marrow which is collected within the middle cavity of the larger bones, must all pass first thro' the periosteum; and in like manner the veins which carry back the blood that is left are received by the periosteum. For which reason this membrane is entirely vascular, as Ruysch^b has curiously demonstrated; and is almost in every point of it connected with the bone, by the branches of the vessels which pass from the periosteum into the bone, and the veins returning thence; so that its adhesion is exceeding firm, and more especially in younger people. For in old age, after many of the vessels are destroyed, the periosteum is observed to be less firmly united to the bone. Dr Havers^c, who wrote his curious observations on the bones before Ruysch's discoveries were known to the world, amazed at this firm cohesion of the periosteum with the bones, was of opinion that this union was brought on at that time of life when the bones were as yet soft and glutinous. And yet this very curious gentleman had taken notice, that the periosteum was fastened to the bone by very small fibres, arising from the periosteum, and penetrating into the very substance of the bone; and these very small fibres, as has since appeared from the injections of Ruysch, are small vessels passing from the periosteum into the bone, and are almost infinite in number. Nor is a vascular periosteum peculiar only to the larger bones, but a resembling very thin membrane covers also the very small bones of the ear, which some very considerable men have asserted to be without any such covering; nay, the very internal cavity of the ear has been found by Ruysch^d to be covered with its periosteum, and to have had innumerable vessels spread over it, and accordingly has been so delineated by him.

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§. 521.

^b Adversar. decad. 3. tab. ii. fig. 8.^c Osteol. Nov. p. 22.^d Epist. Anatom. ix. p. 10, 11. tab. iv. fig. 1, 10.

§. 521. **H**ENCE again (520) a third series of the diseases of the bones.

Whatever cause therefore shall hinder the free passage of the humours through the vessels of the periosteum, or their return from the bone into the periosteum, shall likewise produce diseases in the bone, though the first and efficient cause of these diseases shall perhaps not lie in the proper substance of the bone, but only in the periosteum. This will easily appear from what we have advanced in the preceding paragraph. Here then, again, we have a new class of diseases in the bones.

§. 522. **T**HE bones have also an internal periosteum surrounding and covering the hollow receptacles of the marrow, conveying the arterial vessels into the medullary vessels, and receiving thence innumerable veins of different sizes.

This internal periosteum is not so easy to be shewn as the external; and yet there seems to be such a fine membrane in being, though exceeding thin, as being secured by the hard covering of the bone. The skull is lined with the dura mater, which discharges the office of an internal periosteum; but as this membrane sends forth sheaths to guard the nerves which issue from the medulla oblongata and spinalis, it was requisite that it should be of a thicker and more compact contexture. But as in the larger hollow bones this membrane is defended from all external injury, and has no other use than to cover the inward surface of the bones, and receive the vessels, it did by no means require any considerable degree of firmness and strength, and for this reason being extremely thin it is seldom discovered. And in the bones, which have their inside entirely cellular, it is not very easy to trace it, by reason of their intricate structure; and the same may be said of the extremities of the larger bones, where the seceding bony

bony lamellæ make up that surprising spongy substance. But this membrane should more particularly be found in that part of the larger bones, which from the close union of the bony lamellæ is of a most solid consistence, and has a large cavity in the middle for the reception of the marrow. Ruysch had observed, that anatomists speak often too freely of the membrane which they apprehend incloses the marrow; and has said ^a, that in the bones, whose whole cavity is filled with an osseo-spongy, or osseo-filamentous substance, there is no such thing as one common membrane belonging to the marrow; and that this is not to be wondered at, as in this case the marrow is not collected, but lies dispersed through these several channels. And yet in another place he thus describes the structure of the os humeri in a boy, which he had cut in two longitudinally, and has also delineated: *The internal substance, which is osseo-spongy, is supplied with a medullary liquid, and covered with a fine membrane as thin as a spider's web. It is replenished however with arteries, and for this reason looks red* ^b. And in the same Thesaurus ^c he describes a portion of the os femoris in an infant, which had been cut off, in the cavity of which was a thin membrane to be seen, as fine as a spider's web, surrounding the marrow, as also very small artaries spread over it. From whence it plainly appears, that there is such a thin membrane within the internal cavities of the bones. And yet perhaps it may seem questionable, whether this thin membrane may belong to the marrow, or be an internal periosteum of the bone, or whether it may not discharge both these offices. But if we consider what Dr Havers ^d has said concerning the structure of the marrow, it will seem highly probable, that this membrane is distinct from the marrow. For he says, that the whole medullary mass is covered with a very thin and transparent membrane, that in ma-

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^a Adversar. decad. iii. p. 32.

^b Substantia interior, quæ osseo-spongyosa, medulloso liquore imbuta, et membranula adeo tenui obita, ut telam araneæ adæquet. Hæc autem superbit arteriolis repletis, et exinde rubedine prædita. *Thesaur. X. Tab. iii. fig. 2.*

^c N^o 182. p. 72.

ny places appears coloured, as if it was tinged red by the blood-vessels which are spread over it. But upon carefully separating this membrane from the marrow of a thicker consistence, he frequently found the vessels, which were dispersed over the surface of the marrow, to remain whole; and adds, that he was very sure these vessels did not belong to the surrounding membrane he had then taken off: and presently after he says, that this membrane adheres to the bone, not only by small veins, but also that it insinuates itself into the transverse pores which are found on the inside of the bone. From which description it is evident, that a very thin membrane is closely united to the internal surface of the bones, and that under it there are vessels (undoubtedly disposed in a regular manner in another membrane) spread over the surface of the marrow; and consequently this internal periosteum must be distinct from the marrow contiguous to it. The use therefore of this periosteum might be, not only to convey the arterial vessels into the medullary vesicles, and receive the veins returning thence; but also to supply the bone itself with life and nourishment, by the vessels which it transmits into the substance of the bone, and likewise receives from thence. And does not this seem conformable to some surprising observations, which have occurred in diseases of the bones? Ruysch^e has given the description and figure of a carious bone in the arm, which contained within its cavity a bony pipe, so entirely separated from the external substance of the bone, as to be capable of being moved any way. In this case, it seems not very improbable, that the internal part of the bone, which more immediately receives benefit from the internal periosteum, was affected with some disorder, that had its first rise in the internal periosteum; and that from thence the internal hollow part of the bone seceded from the external part that was left behind.

^d Osteol. Nov. p. 164, 165.
tab. ii. fig. 1.

^e Thesaur. X. n^o 176. p. 69.

§. 523. **H**ENCE a fourth division of diseases in the bones.

For, as we have observed this membrane to be vascular, an obstruction, inflammation, and all its consequences, may likewise take place here; and from hence both the contiguous bone, and the marrow which lies immediately under it, may contract disorders, as we shall presently shew.

§. 524. **T**HE bones have an immense number of vesicles in their cavities, filled with a subtile medullary oil, which they reserve, and distribute both mutually into each other, and also between the interspersed vacuities of the lamellæ, into the cavities of the joints, and through the straight pores. These vesicles have arteries, veins, lymphæ-ducts, adipose-ducts, small nerves, and membranes.

We have already treated of the vesicles filled with a subtile medullary oil, which are seated in the cellular part of the bones, under §. 518. but what we here speak of is the *marrow* properly so called, which is repositied in the hollow part of the larger bones, and is made up of an infinite number of vesicles collected together, and included under one common membrane. Dr Havers^a had observed, that the medullary oil was not an uniform mass lying within the cavity of a surrounding membrane; but that it was contained in very small vesicles, which when united formed larger lobules included in a proper membrane; and that the whole mass of marrow, as it is to be seen in the cavities of the larger bones, was made up of a number of these lobules joined together. Farther, the smallest of these vesicles, containing the medullary oil, seem to have a communication with each other; as have also the lobules, which are made up of a number of them.

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united: so that the oil is capable of passing from all parts of the marrow, even the most distant, both to the substance of the bone, and the cavities of the joints. For when Dr Havers pricked the membrane of one of these medullary lobules, he observed, that the oleaginous substance did not run out all at once, but flowed gradually; yet that the whole was capable of being squeezed out by so slight a pressure as was insufficient to break through the sides of the smallest vesicle: And when he laid a hard piece of marrow to melt before the fire, he observed, that as the fat melted, it flowed out gradually, and left the lobules and vesicles empty behind. This is farther confirmed by this circumstance, that the quantity of marrow shall be lessened by violent exercise and fasting, and increased by rest and a more plentiful diet; which du Verney^b affirms he was convinced of from many experiments, and who also describes the structure of the marrow in the same manner as we have done above. This medullary oil seems to pass three ways out of the vesicles, wherein it is collected. For it is either carried through the communicating vesicles and lobes towards the extremities of the bones, and there transudes thro' the pores of the cartilages which cover the ends of the articulated bones, into the cavities of the joints, (see the commentary on §. 362), in order to facilitate the motion of the bones without any inconvenience from the attrition of the joint; and therefore, also, the quantity of marrow is diminished after violent motions: Or perhaps, when attenuated, it enters into the small absorbent veins, and mixes with the blood; for in acute distempers we certainly see very frequently, that all the fat in the whole body shall in a few days time be in a manner consumed: Or, lastly, it seems to enter into the very substance of the bones, and to give them a just degree of cohesion and unctuousity. As Dr Havers^c was searching for the passages by which the medullary oil gains admittance into the substance of the bones, he discovered the inner lamina of the bones to be struck through

^b Acad. des sciences, l'an 1700. Mem. 255. P. 43, &c.

^c Osteolog. Nov.

through with little holes, through which, after the strictest examination he could make, he never found any vessels either passing to the marrow, or returning from it. In the succeeding lamellæ he discerned the like pores, though not lying precisely opposite to the others, but situated in different places; insomuch that the medullary oil could not directly pass from the pores of the inner lamina into the pores of the lamina that lay next to it, but, after it had penetrated the first lamina, must have moved between this and the succeeding lamina till it had found a like pore in this lamina to pass through, from whence it would in like manner be carried again between the second and third lamina till it entered the pores of the third, and so on successively till it came to the outermost of all. These little holes, through which the medullary oil passes, the doctor has called by the name of *transverse pores*; and the passages, along which the said oil runs between the bony lamellæ, before it enters the pores of the next lamina, he has named *longitudinal pores*, as they lie in the same direction with the fibres of the bony lamellæ. He farther takes notice ^d, that the longitudinal pores are not easily discovered, unless by the assistance of very good microscopes, though they are most discernible in the ribs: and adds, that he could plainly distinguish them in the thickest part of the scapula, where the bony lamellæ immediately cohered; and that he has seen the marrow, after it has entered these longitudinal pores, hanging like oil to the sides of them. He likewise declares, that he has been able to observe them, in an human bone, between eleven or twelve distinct strata of bony lamellæ. The transverse pores therefore only transmit the medullary oil; but the longitudinal ones convey it between the lamellæ, and by this means the interstices of the lamellæ are supplied with this oil. But this distribution of the medullary oil through the substance of the bone takes place only in those parts where the bony lamellæ are contiguous; for near the joints, where the lamellæ lie more remote from each other, are placed the medullary

vesicles

^d Ibid. p. 46, &c.

vesicles described in §. 518, which are capable of supplying the said oil in sufficient quantity.

By this beautiful structure, the medullary oil is uniformly distributed through the substance of the bones : and as the inner lamella of the bone is to transmit a sufficient quantity of marrow, both for its own use and the use of all the lamellæ which lie upon it, for this reason it ought to have a larger number of transverse pores than any of the rest, the next to it less in proportion, and so to continue decreasing till you come to the surface of the bone ; and this the doctor^e found to be true in fact.

And thus the hardest, and driest, and most earthy parts of the bones (see §. 512.) are supplied with a very fine oil ; and perhaps it is by this oil that the earthy parts are joined together, as it were by a kind of glue. For if the bones are deprived of their oil by being exposed to the fire, they will become brittle ; and if, after having been calcined by the fire, they be steeped in oil, they will again acquire a new degree of cohesion ; as we have already observed in the commentaries on §. 21.

The reason is farther evident from hence, why bones, which have thus thoroughly imbibed an oleaginous substance, shall afford so good fuel to fire ; inasmuch that, as Herodotus^f tells us, the Scythians, for want of wood, dressed their flesh with a fire made of the bones of their victims ; and, in case they had no kettles at hand, threw the flesh of their sacrifices into their paunches, and, pouring in water, placed them upon the bones they had set on fire, and thus made one part of the ox an instrument of cooking the rest. For the same reason we see, why skeletons, which have been thoroughly well cleaned, and had all the marrow perfectly carried off in boiling through the holes which were perforated in the larger bones, do notwithstanding afterwards turn yellow, and frequently also exhale an oleaginous substance, the medullary oil, which lies between the bony lamellæ, rising by degrees and shewing itself upon the surface.

This medullary oil is separated from the arterial blood,

^e Ibid. p. 44. ^f Melpomen, five lib. iv. p. 240, 241.

blood, collected in the vesicles, and then passes out of them to discharge the uses appointed it by nature. Dr Havers has observed ^g, that the arteries leading to the marrow are entirely distinct from those which convey the vital humours through the substance of the bones, and are carried also as far as the marrow thro' particular openings made for them in the bones, but yet so as not to penetrate directly into the cavities of the bones, but to pass obliquely through their substance, before they come to the marrow, and frequently for a considerable length: for ^h the same author has seen such an artery running within the substance of the bone for the breadth of an inch and a half, though the thickness of the bone in that place did scarce go beyond the eighth part of an inch; nor could he ever discover, that an artery of this kind did at any time send out any ramification ⁱ through the substance of the bones. However, after it had reached the cavity of the bone, it was for the most part divided into two branches, tending to the two opposite extremities of the bone, and divided by innumerable little branches distributed thro' the medullary vesicles. But tho' this ingenious gentleman had by the help of a microscope seen several blood-vessels dispersed through a very small medullary vesicle, yet he frankly owns, that he could not discover, whether every vesicle was supplied with the like vessels; and seems rather to have been of opinion, that this circumstance was not absolutely requisite, as the vesicles communicate with each other, and by this means the medullary oil secreted from the arteries in some of the vesicles may be conveyed to the rest. It is plain however, from the injections of Ruyfch, that the whole substance of the marrow is in every part of it supplied with vessels of this kind, and for this reason it seems highly probable that the like vascular apparatus takes place in all the medullary vesicles.

After the secretion of the medullary oil, the remaining blood is returned by the capillary veins, which uniting in larger trunks at last form one distinct vein, which for the most part passes back by the same aperture

^g Osteol. Nov. p. 162.^h Ibid p. 37.ⁱ Ibid. p. 161.

ture through which the artery entered. And yet the doctor has observed, that very small veins coming from the marrow have penetrated into the very substance of the bones, and there have disappeared: and possibly these are the veins which carry back the blood of the arteries that supply the marrow with nutriment; for in many other places of the body we have a twofold apparatus of arteries and veins, whereof the one shall serve for the secretion of a peculiar liquid, and the other supply the part itself with life and nourishment.

But as from an injection some parts of the marrow shall look red, which before were white and transparent; it is plain that we have here the lesser orders of vessels, and lymphatic vessels of course. This appears farther also from hence, that all the cavities of the body, great as well as small, are moistened by a very fine exhaling liquid, and therefore we shall have here also resembling absorbent veins.

But whether there be here any adipose ducts to convey the medullary oil collected in the vesicles to the places designed for it, the doctor ^k owns he never could find out; and seems rather inclined to think, that the contiguous sides of these vesicles have holes in them, by which they communicate with each other. And yet he found ^l very manifest adipose ducts, through which the medullary oil passes from the cavernous part of the bone into the cavities of the joints.

That there are nerves in the marrow, has been shewn by Du Verney ^m to a demonstration. He plainly discerned a nerve passing to the marrow, with an artery and a vein, through the substance of the bone; and has observed, that these three vessels are all included in one common sheath, which is a production of the periosteum. Besides, he has proved by manifest experiments, that the marrow is sensible of pain. For in the hospitals, upon renewing the dressings after the amputation of a limb, he frequently ordered his assistants to press something against the marrow, as it lay exposed, and the patient always expressed a strong

^k Ibid. p. 169.
Mem. p. 253, &c.

^l Ibid. p. 173.

^m Acad. des Sciences 1700.

strong sense of pain. And to leave no room for doubtfulness concerning it, he cut off the leg of a living animal before the members of the Royal Academy of Paris; and after waiting a while, till the cruel pain which attended the operation, was over, he thrust a probe into the marrow, and immediately the animal expressed a sense of the most exquisite pain. This experiment was several times repeated with the like success.

§. 525. **H**ENCE (524) the fifth and last distinction of diseases in the bones arising from this division.

As therefore there are so many different humours, and such a number of vessels, in the very marrow of the bones, almost all the diseases we have hitherto mentioned may likewise take place here. This therefore will be another, and the last class, of diseases in the bones. The diseases inhering in the *substance* of the bones properly so called, have been first treated of; and their diversity derived from the difference of their situation, either in the broader and cellular part of the bones near the joints, or in the middle and more solid part. Next to this came under consideration the vesicles or bladders, full of medullary oil, which lie in the cellular part of the bones; and it has plainly appeared, that another sort of diseases was capable of being produced from hence. Thirdly, we took notice of the external periosteum, which covers the convex side of the bones; and another fund of diseases was likewise shewn to be supplied from thence. Fourthly, the like observations have been made upon the periosteum, which lines the inside of the bones. Fifthly and lastly, the structure and use of the marrow, which is found in the cavities of the larger bones, have been laid down from the discoveries of the best anatomists, that the diseases arising from thence might likewise be discerned. From all which premisses duly considered, the diagnostic signs of the diseases which have been observed in the bones will be more evident; the prognostic

nostic formed from them, and pointing out the various events of these diseases, will be surer; and the indications requisite to the cure of them, which in each of them will sometimes be different, may more readily be determined according to the rules of art.

§. 526. **I**F the medullary oil (518, 524) stagnates in its vesicles, ducts, or in the vacuities interposed between the lamellæ of the bones, from heat and vital motion it becomes acrid, putrid, and sanious; in which case it will interrupt a fresh secretion, close up the conveying and secreting vessels, inflame the vesicle, cause it to suppurate, or dispose both liquids and vessels to putrefy and gangrene; and hence the very substance of the bone being destitute of vessels, deprived of vital liquid, eroded by acrimonious substances, will be converted into a kind of cineritious calx, where it is thinnest, that is, in the cells of the apophyses; and this will be succeeded by a pain, heat, throbbing, swelling, abscess, and very bad *caries*. This stagnation may arise from any obstruction; (see the chapter concerning Obstruction): but if it proceeds from an internal cause, it is then generally called a *spina ventosa*.

In this paragraph the diseases come under consideration which happen to the bones, when the medullary oil, that is secreted from the arterial blood, and deposited in the vesicles, which lie either dispersed in the cellular part of the bones, or collected in the marrow, stagnates and is corrupted.

From what has been said upon §. 524, it is plain, that the oil is collected in very small vesicles; reserved there for proper uses; and possibly for a time may continue at rest there, or at least be very slowly moved. For in animals that have lain still it is commonly found in a very large quantity, and after violent motions of the body it is much diminished. By stagnation

nation, therefore, is here understood such a state of the medullary oil, or of the parts containing and conveying it, as disables it from complying with those motions which are required of it for the discharge of those uses that are necessary to health. For this medullary oil should be capable of being exhaled into the hollow places of the joints, in order to lubricate them; it should be capable of entering into the vacuities lying between the lamellæ of the bones; it should be capable of passing freely out of the smallest vesicles into others of a resembling nature that are contiguous, till it arrive at the forementioned stages. Whatever therefore shall interrupt this motion of the medullary oil, will cause it to stagnate. We see farther, that all oleaginous substances, however mild, are spontaneously disposed to become exceedingly acrimonious, some sooner, and others later. The oil of sweet-almonds, which is extremely mild when fresh drawn, shall in the summer time turn so acrid within a few days, as to feel hot in the mouth while it is swallowed down. Butter likewise is liable to turn in the same manner, though not altogether so speedily. It is true indeed, that this alteration is the more hastily brought on by the free admission of the air: and therefore the marrow, which stagnates in the cavity of the bones, will for this reason be more slowly changed; but yet if it stagnates long, it will in like manner degenerate. The vital heat, however, will soon dispose it to putrefy when in a stagnating state, and the more so as marrow is naturally prone to putrefaction; for the marrow of the soundest animals is very apt to change within a few days after they are killed, and to stink most intolerably; at the same time, laying aside the tenacity of oil, it will dissolve into a thin and putrid corruption. It is plain therefore, that very terrible disorders must necessarily follow in this case, if we consider the very tender frame of the parts which secrete, collect, and convey the medullary oil. For the arteries passing to the marrow, as soon as they have entered the cavity of the bone, divesting themselves, as it seems, of their harder coats, become so soft and pulpy, that even

the marrow of an old ox, when held between the fingers, will easily melt into an oleaginous liquid. When once therefore this change is begun, the medullary oil being converted into an acrid sanious substance will erode the vesicles wherein it is contained, and in like manner destroy the adjoining vesicles that are found in its passage by them; so that the rise of a disorder of this kind in a small part of the marrow shall easily propagate the contagion to the rest. These small vessels therefore are capable of being inflamed, and all the consequences of an inflammation may follow upon it. But as a putrid sanious matter is naturally very sharp, there can scarce here be any room left for a kindly suppuration: or though this should be the case, the purulent matter, collected in a close place, and so pent up as not to be able to obtain a passage thence, would in like manner grow thin and putrefy; so that the vital vessels of these parts being all utterly destroyed, a gangrene of the worst kind must of necessity be the consequence.

Besides, as the malignity of this putrid sanious matter is every day increasing, it must be continually growing worse; and, as it flows along the inside of the hollow part of the bone, will soon destroy both the external membrane of the marrow, and the internal periosteum; and the bony substance of course, being thus deprived of the vital vessels, will in like manner be eroded by it, and destroyed. But this will soonest happen in the broader part of the bone, (see §. 516.) or in the cells of the apophyses, where the bony substance is most tender, and the medullary vesicles lie between distant lamellæ; so that in these places the bony lamellæ being contiguous on both sides to the corrupted medullary oil, they will of necessity be the sooner destroyed. On the other hand, near the most solid part of the bone, the bony substance will be destroyed more slowly, both as the bone is thicker, and as the corruption touches only the internal lamella: and yet this sanies shall by degrees insinuate itself into the pores of the internal lamellæ, its subtlety increasing with its acrimony, and so proceed to pass between the

the bony lamellæ, in like manner as the medullary oil described above, in §. 524; and by this means the bony substance shall be so eroded, that all cohesion shall be dissolved, and the most solid bones converted into a mere calx. Thus whilst we were discoursing of fractured bones, we shewed that even the larger bones of the body, when grown carious, break with the smallest force. See §. 344.

As, therefore, there may be an inflammation, with all its consequences, in these parts; and it appears, from what we have advanced under §. 524, that the marrow is sensible of pain; the reason is evident, why pain, heat, throbbing, &c. are all found here. We have likewise had very extraordinary tumours formed by the gradual removal of the bony lamellæ to a greater distance from each other, especially near the joints, and increasing the bulk of the bone to a monstrous size. A womanⁿ had bruised her knee by a fall: and a tumour afterwards appeared in the place that was hurt, which seemed to be fixed both in the soft parts and in the bone itself, and increasing gradually for eight years together, was grown most excessively big. By accident, after this, a wound was made towards the top of the fore-part of the tumour, the bone was laid bare, and the outer part of it gradually scaled off; and then there was to be seen so large a cavity in the cavernous part of the tibia, as sufficed to hold ten ounces of a liquid that was injected, without suffering the least drop to run out. Amputation seemed to be the only remedy that was left; and as it was judged too hazardous to attempt it in a woman with child, the operation was deferred till after her delivery. But no sooner was she delivered, than all the parts around it putrefied, and she shortly after died^o. M. Petit had a patient with a like large swelling in the same place of the tibia; and when he had opened it, he found a fleshy substance, bigger than his fist, lying in the cavernous part of the bone, and surrounded with a fetid pus; which he first extracted, and afterwards cutting away the corrupted

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parts.

ⁿ Acad. des Sciences, l'an 1737. Hist. p. 34.
ladies des Os, Tom. II. cap. 16. p. 389.

^o Traite des Ma-

parts of the bone with proper instruments, very happily cured him. From whence it is plain, that the soft parts in the cellular part of the bones near the joints are often capable of being wonderfully altered; and that inflammations, abscesses, &c. are sometimes found to have place there. For when the medullary oil is once corrupted, most terrible disorders will ensue, and even a dreadful caries of the bones; in which case the corrupted bone is in a manner turned to dust, and gives no resistance to the probe that is thrust against it. Whence that of Celsus: *In a caries, a judgment is easily to be formed; for if a small probe be thrust into the cavity, by the degree of its admission you may know whether the caries be deep or superficial*^p. A caries therefore is the worst malady to which the bones are subject, and indicates an almost total corruption or erosion of them: slighter disorders are usually cured by a separation of the corrupted lamellæ by exfoliation; a caries never, but must be taken away by incision or burning, till you come to the parts wherein there is life.

Since therefore, as appears from the account we have given of an Obstruction, the stagnation of the medullary oil may be brought about by a great number of causes, it is plain, that the terrible disorders above-mentioned may likewise be owing to a variety of causes. The effects of an external compression or destruction of the vessels, however, are less likely to occur here, as the marrow is so securely defended by the covering of a hard bone. And yet there is no question but that the marrow may be injured by violent contusions and fractures of the bones. But when, without any external injury, the medullary oil shall be corrupted from an internal cause, there the disease is generally termed by physicians and surgeons a *spina ventosa*; which disease was first^q described by the famous Arabian physician Rhazes, and so named because

^p In carie quidem expedita cognitio est, si specillum tenue in foramina demittitur, quod magis minusve intrando, vel in summo cariem esse, vel altius descendisse, testatur. *Lib. viii. cap. 2. p. 508.*

^q Freind's Hist. of Physic, Vol. II. p. 55.

it consisted in a corrosion and corruption of the bone, attended with pungent pain and swelling. This appellation displeased Marcus Aurelius Severinus, who has wrote a whole treatise upon this subject, and chuses rather to call it by a compound Greek word *Pædarthrocace* or the *joint-evil* of children ^r, both because children are more subject to it, and because it is most frequently found to lie near the joints. His definition of it is as follows ^s: *Pædarthrocace abscessus est corruptorius, seu sphacelismus ossis, circa articulum in pueris, ex primis spermatis et menstrui sanguinis inquinamentis non repurgatis, per congestum illapsis et computrescētis, natus*. He does not deny, however, but that it may sometimes happen to persons of more advanced years, and has himself ^t given an instance of a grown-up woman who laboured under this disease. Peter de Marchettis ^u says, that he has seen several persons, both men and women, who have had this disease, at every time of life under the age of five and twenty years; but that he never observed it in any older persons, unless they had been subject to it before, and had not been cured. But as the tumours about the joints of ricketty children are frequently without the corruption of the bone, the name of *pædarthrocace* seems to be too doubtful an expression. Nor does Severinus himself appear to be positive in the affair ^v, when in another place he makes it a difficulty, whether the *spina ventosa* and a *pædarthrocace* be the same disease. It will not therefore be improper to retain the name of *spina ventosa* in the designation of this disorder, as it was used by Rhazes, the first author who wrote any thing distinctly concerning the disease; and the signification of it may be sufficiently limited from what we have here observed in this paragraph: and thus it will denote a corruption of the bone, originally derived from a defect in the medullary substance of it, and by degrees spreading through its whole substance, and creating a swelling and pain, either from the erosion of

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^r M. Aurel. Severin. de Recond. Abscess. Natura, p. 37. ^s Ibid. p. 356. ^t Ibid. p. 347. ^u Observat. Medic. Chirurg. Rarior. Syllog. p. 113. ^v De Recond. Abscess. Nat. p. 359.

the periosteum, or its distension by the tumefied substance of the bone. But when a corruption of the bone, beginning externally, shall spread inwards, even though it should infect the marrow, we shall still call it a *caries* of the bone; and by this means all the contentions will be avoided, which have arisen among the learned, whether the *spinosa ventosa* of the Arabians was known to the ancient Greeks, and described by them, or not. For that they were acquainted with the *caries* and *sphacelation* (σφακελισμοί) of the bones, is out of question; but that corruption of the bone, which owes its rise to the medullary substance being first affected, is now here to be found in any ancient Greek writer.

§. 527. **T**HE signs of this disease, and its state (526), are the signs of a deep inflammation, not discernible by feeling.

It is greatly to be lamented, that this disorder is frequently not found out till very late, when the bone is entirely corrupted, and the tumour begins to appear in the flesh and muscles. For which reason great care should be taken, to make a discovery of it, as far as possible, in its first beginning. It is plain indeed, that this must be extremely difficult, if we consider that the disease lies within the bones. And yet the following observations may serve to give us some light in this obscurity: If the patient is known to labour under such an ill habit, as by experience we find is most frequently apt to affect the bones; such, for instance, as the venereal disease, the scurvy, and the rickets in younger persons; which last distemper, as we shall see hereafter, often gives great suspicion of a latent venereal taint; from these particulars we may know, that the causes which predispose to this distemper, do actually subsist in the body. But we have scarce any other distinguishing sign of the disease being present, except that of an obstinate, excessive pain, which lies very deep, and, as the patients usually express it, is fixed in the bone, and attended with a seeming slow erosion

erosion or gnawing. This pain is farther increased by the warmth of the bed, by violent exercise, or the free use of wine and cordials: and yet, though the part affected be pressed or rubbed ever so hard, no increase of pain shall follow upon it; which indeed we may the less wonder at, because the bone intervenes, and by its hardness prevents any external application from acting upon the place affected. These are the signs of the disease in its first stages: But when the bone once comes to be eroded, and the external periosteum to be affected, the pain increases, and grows much more intense upon the least roughness used outwardly to the part; and then there arises a soft tumour in the muscular flesh: though, generally, before this, the very substance of the bone shall rise and swell; in which case the disease is easily to be distinguished; though too late, because the whole substance of the bone being corrupted will either spontaneously fall off from the parts wherein there is life, or must be taken away by incision or burning.

§. 528. **F**ROM the difficulty of the separation, absterfion, and cleansing, many illis may be foreseen, and the cure pronounced very difficult.

If we consider the several particulars already laid down concerning the nature of this disease, we shall clearly see, that there is every thing bad to fear, and that the cure must be extremely difficult. For we have a corrupted medullary oil lying in the midst of an hard bone, which must be absterged and cleansed before a cure can be obtained. But then there is no outlet, by which the corrupted matter can be carried off, unless the bone be either first eroded or trepanned. Besides, this oil will grow sharper continually by the heat of the place and the time of its being pent up, and thus all the inconveniencies arising from it will be increased. Again, if the internal surface of the bone be hereby eroded, the parts of the corrupted bone, though they were

were separated from the sound parts wherein there was life, would be detained in the midst of the cavity of the bone, and both by their bulk and roughness prove mischievous to the marrow, and thus produce fresh disorders. We learn from experience, that surprising degenerations of the bone, intolerable pains, fevers, and death itself, have followed upon this circumstance^a. Ruysch has given us a delineation of the bones of the tarsus, corrupted by a *spina ventosa*, which had fallen under his view, so-blended together into one bony substance, as not to bear the least resemblance of their natural structure. A patient of the same author's had, a few days before death, two spongy swellings upon his thigh, whereof one was a yard and three quarters in circumference, and the other only a quarter of a yard. In a patient of ^{Dr} Severinus's who had been three years complaining, he found, upon examination with his probe, that the metacarpal bones were grown as sharp as a rugged stone, the hand affected being swollen to the size of a child's head. Several other instances of this kind might be produced from writers of credit: From all which we may learn the malignant nature of this terrible disease.

§. 529. **T**HE best method of attempting a cure, is, 1. By copiously filling all the vessels with decoctions made of such ingredients as powerfully penetrate, are very abstergent, and resist putrefaction; 2. By putting all the humours into a violent motion, and raising a sweat by the artificial application of a warm vapour to the body; 3. And, at the same time as the sweat rises, by fixing the motion to the part affected by topical fomentations, and a direct application of the warm vapour to the part itself.

When once the tumour of the incumbent parts
spon-

^a Thesaur. VIII. n^o 68. p. 42. et Thesaur. V. Tab. iii. fig. 4.

^b De Recond. Abscess. Natura, p. 375.

spontaneously opened ^a, according to Rhazes, there could be no cure but by taking out the parts of the corrupted bone by incision or burning. Peter de Marchettis ^b advises, as soon as the pain in the joints of the hands or feet grows pungent, though no tumour should appear, to open the place immediately, and then by incision or burning to clear away the vitiated part of the bone. But before we proceed to this cruel treatment, it may not be amiss to try the following method, which has frequently been attended with very good success.

1. The fuel of the disease lies repositied in the cavities of the bones; external remedies therefore cannot reach it, unless so far as they are licked up by absorbent veins, mixed with the circulating humours, and carried along with the blood to the part affected.

The only remedy left, therefore, seems to be, The filling the body with a large quantity of a thin liquid, naturally disposed to be very penetrating, and deterging, and apt to resist putrefaction; and then to convey it through the vessels, by accelerating the motion of the liquid contained in them, and directing the force of it as much as possible towards the part affected. For there is reason to hope, that by conveying such a liquid to the affected part through the vital vessels subsisting in the substance of the bone, and in such part of the marrow as is not totally destroyed, the putrefaction may be stopped, the corrupted parts separated from the sound wherein there is life, the medullary oil diluted, and, being licked up again by the absorbent veins, carried off by urine or sweat. For that these putrid humours, seated in the cavities of the bones, may be taken up again into the blood, we learn from the putrid hectic fever, which often infects the whole mass of blood, and induces a very bad cacochymy when this disorder has attained to any considerable degree of malignity. Now the mischiefs arising from the return of this putrid matter into the blood may be easily prevented by the free use of such

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^a Freind's Hist. of Physic, Vol. II. p. 57.
Chirurg. Rarior. Syllog. p. 118.

^b Observat. Medic.

a remedy as we are here recommending. The medicaments best serving this purpose, are the woods which abound with an aromatic fragrancy and a large quantity of balsamic resin, such as juniper, box, oak, &c. and, what in this respect exceeds them all, the guaiacum wood, which, when managed according to art, supplies a decoction that is sub-acid and thoroughly balsamic. But as these woods are very hard, and contain a large quantity of resin, they do not easily yield their virtue to water, unless they be first ground to powder, digested for some time with a gentle heat, and then boiled for some hours in a close vessel. It is sometimes customary to add a small portion of an alkaline salt to them, whilst they are in digestion, in order to open the body of them the better; and, towards the close of the boiling, to put in a few ounces of rectified spirit of wine, in order the more easily to dissolve whatever resin shall be left remaining. The form of such a decoction is to be seen in the *Materia Medica* under this article. There may likewise be infused in this decoction the shavings of *sassafras* wood; which, as it consists of very volatile parts, cannot bear long boiling, without losing its virtue. Let the patient take some few ounces of such a strong decoction three or four times a-day; and at the same time use for his common drink a smaller decoction, made by putting fresh water to the ingredients, after the stronger is poured off. A greater or lesser quantity of these decoctions is to be given in proportion to the different age, constitution, and strength of the patient: but it will be adviseable always to drink as much as he can bear; for thus the whole body will be filled as much as possible with a penetrating, detergent, antiseptic liquid, and the first indication towards a cure answered.

2. After the vessels have all been filled by drinking freely of these decoctions for several days, and the body begins in a manner to swell, it will then be adviseable to increase the motion of the humours through the vessels. This motion is capable of being accelerated almost to what degree we please by frictions, and therefore these are generally used upon this occasion:

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but the most commodious method of all is to expose the naked body to the steams of a warm vapour; by which means, both the sweats shall be raised that will carry off the liquid that has been taken down, and a fresh opportunity given of filling the body again with other liquids of a like nature. The patient, then, being stripped of his clothes, and inclosed in a kind of tent made of waxed cloth, is exposed to the steams of warm water, or, what is still more effectual, of spirit of wine set on fire. This warm vapour is of so penetrating a nature, that the body shall scarce be exposed to it a few minutes, before the patient shall grow hot, and break out in a plentiful sweat all over, which has sometimes been observed to smell like the decoction which had been inwardly taken; and this sometimes in so great a quantity, that very strong men shall faint under it, unless the spirit of wine be immediately removed. So that we must be very cautious in this administration; for it is very certain, that, in attempting to cure the venereal disease by a resembling method, several persons have been killed by unskilful practitioners, who have obliged them to sweat more than their strength would admit. Half an hour in a day is enough for weak people to sweat in this manner, and the strongest are scarce able to hold out two hours; and it is always adviseable to have the physician present during the sweat, that as circumstances arise he may know when to stop. When this is done, the body must be well rubbed with linen, and the patient laid in a warm bed, where frequently he will still sweat gently for an hour or two longer. But as there will be a good deal of hazard in exposing the body in this state to the coldness of the external air, it will be necessary to make the air of the room warm, wherein the patient lies, by kindling a proper fire in it. For which reason some people chuse to lay the patient naked in bed, and by a convenient funnel to convey the steams of the spirit of wine to the several parts of his body under the bed-clothes; and thus the hazard of being exposed to the air will be avoided. But whether the patient sweats in bed, or out of it in

a four-cornered chest, or some such-like machine, (the *tub*, as it is usually called), care must be taken to keep the head out, for fear of suffocation. When the sweating is over, it will be proper to give a little broth made from lean meat, or a small glass of wine, to recruit the spirits, which are frequently sunk by profuse sweatings.

3. It is evident enough, that, by accelerating the motion, such a very penetrating decoction as this is uniformly carried through the whole corporeal system. But it is farther requisite to direct the efficacy of the medicine chiefly to the part affected. In treating of the cure of an obstruction (see §. 134.) we observed, that the force of the medicines, which were taken inwardly, might by the assistances of art be directed to any part of the body we pleased. And these assistances consisted in the proper means of augmenting the impetus and quantity of the vital liquid in the parts towards which, according to the indication, the efficacy of the medicines was to be derived: and this was to be obtained by lessening the resistance of the vessels in the said parts, and increasing in them the velocity of the circulation; the former, by the application of warm emollient fomentations, resembling cataplasms, or sometimes cupping-glasses; and the latter, by frictions and stimulations. It will be extremely useful, in diseases of this kind, to foment the part affected with flupes dipped in a hot decoction of guaiacum, and at the same time so to direct the steams of the spirit of wine as to make them principally fall upon the part affected.

§. 530. **B**Y this method, if long continued, great benefit shall frequently arise, especially if joined with a diet that is low and opposite to an oily putrefaction.

If all the particulars laid down in the preceding paragraph be duly observed, the very penetrating decoction there recommended will by an increased velocity of the circulating fluid be very swiftly carried through all

all the vessels, and being principally directed to the part affected by the application of fomentations, warm vapours, &c. whatever is corrupted will be cleansed away and carried off by sweatings. But we must not expect that such an obstinate disorder can be removed in a few days; so that sometimes it will be expedient to pursue this method of sweating for three weeks or a month, a due regard being all the while had to the strength of the patient. In the mean time the body is to be supported with good food, of easy digestion, and not fat. For by this method the patients are generally emaciated to the last degree, the fat of the whole body being almost entirely dissolved and carried off by sweat; and as the principal malignity of the disease lies in a corrupted oil, whatever is fat ought justly to be avoided, that it may not supply new matter for the disease to feed on. Broths therefore, drawn from lean meat, without any the least fat, biscuit, gruels made with barley, oat-meal, rice, millet-seed, panadas, and ripe fruits, are the food which in this case is most suitable. And for drink, we may allow whey, or milk mixed with thrice the quantity of water; though the best of all, is a weak decoction of guaiacum, which by an addition of raisins, liquorice, &c. may be made grateful enough.

Where all these particulars have been carefully attended to, the success has been favourable even in cases where the extirpation of the part affected has been by some judged advisable. The remission of the symptoms, and the subsiding of the tumour, are the principal signs whereby we know that the cure goes on in a right manner. And yet it may be proper to observe, that the structure of the bones is sometimes so altered by disorders of this kind, as to leave during life a larger swelling in the bone affected than there ought to be, tho' the corruption of the medullary oil be happily cured; yet such tumour will be no otherwise hurtful than as it makes a disagreeable appearance. There is an extraordinary case, in the *Edinburgh Transactions*^a, of a girl of seven years old, who in a resembling disease, af-

ter having persisted in a course of a decoction of the woods twice a-day for six months together, and drank beer medicated with antiscorbutic herbs for her common drink, had almost the whole substance of the tibia cast off; so that the part of sound bone remaining near the knee was scarce three fingers breadth in length, and what was left about the ankle was hardly half so much: and yet the loss of so large a quantity of bone was so far supplied by a callus, that she was capable of running, dancing, &c. with the affected leg, without any impediment; only there was some deformity left in the shape of the new-made bone, from her having rested upon it before the callus was grown perfectly hard. Her parents imagined that her disorder was owing to an accidental blow: but some considerable time after the cure, an ulcer appeared in the upper part of the arm, out of which there soon after came sharp splinters cast off from the os humeri; which gave a sufficient proof, that the former illness ought rather to have been ascribed to a latent internal cause, since the like disorder had shewed itself again in another part of the body without any external injury.

But as this disease frequently occurs in children, they cannot always be prevailed upon to drink a sufficient quantity of these decoctions, nor would their tender constitutions admit of such profuse sweats as this method would produce. For which reason it would not be amiss, if in this case a gentle hydragogue purge was given them once a-week, and in the intermediate days mild antiscorbutics; the part affected being constantly wrapped up in cloths dipped in very penetrating fomentations prepared from vinegar, salt, the urine of a person in health, rue, wild-garlic, &c. whey being also used for their common drink. By persisting in this method for several months, I have sometimes seen a cure effected: but then there is generally a small aperture in the integuments, out of which there issues a quantity of sanious matter, and the swelling of the bone gradually subsides; and sometimes also the parts of the corrupted bone find thence a passage, the cicatrice afterwards remaining extremely hollow. In a girl, who had

had the bones of the tarsus and metatarsus in the right leg thus affected, and swollen to a monstrous bulk, and who had also the appearance of a like disorder in the elbow and radius of the right-arm, I pursued this method of cure for full two years; but so, that as she grew better I purged her only twice a month, and at last but once. In the foot, the integuments were opened in several places; yet the swelling gradually subsided in such a manner, as to admit of her walking commodiously, though the bones remained so far tumefied as to exceed their natural bulk.

But when this distemper is so far advanced, that the marrow is almost entirely corrupted, and the vital vessels dispersed through it absolutely destroyed, scarce any benefit can be expected from the most effectual remedies. For decoctions can be of no service: as they cannot convey their virtues to the parts affected, unless the vital vessels be sound and whole. The worst events are in this case to be feared; as the corrupted oil, which daily continues to grow worse, remains fixed in the cavity of the bone. The only remedy left is, by applying the trepan, to open a way for the corrupted matter that is here lodged to pass off; for thus we imitate the course of nature, which sometimes throws off whatever is corrupted by eroding the bone. That this method has succeeded, we are informed by surgeons of the best character. A certain person in the venereal disease had a tumour in the tibia; after a salivation, the swelling disappeared, but the pain did not entirely cease, and, within a fortnight after the cure was over, began to increase. After several applications to no purpose, the integuments were laid open quite down to the bone, but without any relief; two days after, the bone was trepanned, and part of it cut off, so that the opening reached into the cavity, and immediately there issued out a very fetid sanious matter, the whole medullary substance appearing to be thus corrupted. Three apertures of the like bigness were afterwards made in the bone by the trepan, the parts left between the apertures cut away, and the remainder of the corrupted bone touched with a cautery;

and the man recovered. And the famous surgeon M. Petit^b tells us, that he pursued the same method, in the case of a girl under his care, with the like success.

§. 531. **I**F there be any obstruction in the texture of the arteries or veins, or even of the lymphatic vessels (513, 516, 520, 522) for want of fresh liquid, or by the stagnation of the liquid already brought, resembling diseases will again arise in the same parts, only in a different order.

Thus have we shewn, what terrible disorders will arise, if the medullary oil shall chance to stagnate in its vesicles, or in the interstices of the bones, and be corrupted. But that the medullary substance may be duly secreted, and after it is collected, and not consumed by the motions of the body, be again perhaps in part licked up by the veins, it is requisite that there should be a free circulation of the humours through those vessels, which both convey liquids to the marrow, and bring them back from thence. If therefore there arise from any cause whatsoever, an obstruction in the texture of the vessels which are distributed through the lamellæ that lie at a distance from each other near the joints, or in those which lie dispersed in the *internal* periosteum, or in the membrane which externally covers the marrow, the secretion of the medullary oil will be interrupted, and the oil already secreted will stagnate, the very small medullary vesicles and their emissary ducts being compressed by the neighbouring vessels which are obstructed and tumefied. And the same effects will follow upon an obstruction in the vessels of the *external* periosteum: for we have already observed in §. 520, that the periosteum which covers the convex surface of the bones, both receives and transmits all the vessels which either pass into the cells of the bones or the medullary substance, or return from thence; and therefore that

^b Traite des Maladies des Os, Tom. II. p. 525.

a disorder produced in the external periosteum may be propagated through the whole substance of the bones and the marrow itself. Only this difference will be in the case, that the mischief will be wrought in a different order. For where the medullary oil is first corrupted, being changed into an acrid sanious matter, it will erode the vesicles wherein it is contained, as also the vessels whereof they are composed; and will in like manner destroy the inclosing membrane of the marrow, the internal periosteum, and the very substance of the bone; which being once eroded, it will likewise fall upon the external periosteum, and so the mischief is propagated from the internal to the external parts. But when the disorder begins from the inflammation of the external periosteum, it proceeds from the external to the internal parts; and, first affecting the bone, spreads the infection to the substance contained in its cavity. For that the disorders of the periosteum immediately affect the bone itself, we have shewn in our account of the wounds of the Head, §. 249; and Aristotle^a had before observed, that bones are apt to turn carious when deprived of their membranes, *Ψιλλόμενα τὰ ὅσα τῶν ὑμένων σφακελιζοῦνται*. And how suddenly the vital structure of the bone may be destroyed by a disorder in the periosteum, we particularly see in a paronychia, when a violent inflammation seizes upon the periosteum that covers the last joint of the fingers, and is attended with intolerable pain. For this complaint shall not last many hours, before the joint shall mortify and afterwards fall off.

§. 532. **O**F which (§531) consequently the diagnostic, prognostic, and cure, are the same (§529, 530.)

For as the mischief will in time reach to the medullary vesicles, after the texture of the vessels of the external periosteum, of the bony substance itself, of the internal periosteum, &c. has been before affected,

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^a Histor. Animal. lib. iii. cap. 13.

the effects and consequences will be the same as were laid down in §. 526; and of course the same method of cure will be required.

§. 533. **A**ND it is plain, the difference of the danger lies chiefly in the difference of the place where the first cause of the disease has its origin and seat. From which particulars being first premised, the nature of these diseases may more distinctly be discerned.

Though even a very slight inflammation of the external periosteum may give rise to the most terrible disorders which spring from a corruption of the medullary oil; yet it is plain, that it may more easily be cured, than if the internal periosteum, or the membrane inclosing the marrow, were the parts inflamed; as in the former case we have greater reason to expect benefit from external remedies; and in many parts of the body, by cutting through the integuments, we can have access to the place affected; and consequently the separation, absterfion, and cleansing, may more easily be performed. The place, therefore, where the cause of the disease first has its original and seat, makes the case very different; and, *ceteris paribus*, the danger is always greater in proportion as the distemper lies deeper. From what we have already advanced, however, we may more clearly discover the nature and cure of diseases in the bones.

§. 534. 1. **T**HAT inflammation of the bone will be milder, which proceeds from an inflammation of the external periosteum, whose causes are numberless (see the whole history of Inflammation) and effects known.

2. It is known by the signs of an inflammation lying deep, and which are increased by pressure.

3. And unless it be presently cured, many disorders are foreseen to follow upon it.

4. It

4. It is cured as an inflammation, chiefly by taking care to throw it entirely outward from the bone; which is done by fomentations, and sometimes by incision.

1. The mildest, therefore, of all the diseases to which the bones are subject, will be that which begins in the external periosteum. We have observed, under §. 520, that the external periosteum consists of a texture of infinite vessels; and therefore an inflammation may take place here (see §. 373, 374.) and arise from an almost infinite number of causes, recited in order in the history of an inflammation. But when once an inflammation is formed, all the effects of it will follow, and various events are to be expected.

2. The principal signs of an inflammation (see §. 382,) are, A swelling, redness, pain, heat, and throbbing in the place affected: but if only the external periosteum be inflamed, and there be no inflammation in the incumbent parts, it is plain, that neither the swelling nor the redness can be perceptible; and that in this case the pain and heat, and sometimes a throbbing, must be the signs of the inflammation. But if the part affected be so pressed upon, that the effect of the pressure shall reach to the periosteum, the pain must of course be increased; and by this circumstance it is distinguished from an inflammation of the internal periosteum, or of the membrane inclosing the marrow, or of the medullary substance itself. For (as we have observed under §. 527), in these latter cases, the pain is not augmented by any external pressure, as these parts are all secured by the safe covering of an hard bone. And in these places too, where the bones are covered with very strong muscles and a large quantity of fat, as for instance about the os femoris, it must be a very violent pressure that can cause any augmentation of pain.

3. For as all the vessels, which are conveyed to the substance of the bone, must first pass through the external periosteum, and abundance of those innumerable

able little branches are distributed through the periosteum before they are inserted in the bone; an inflammation here must evidently be extremely dangerous. For all the disorders recited in the numbers here referred to may be produced by an inflammation of the periosteum. And though the defect in the bone be very slight only, yet most tedious disorders shall frequently follow from it. For though the bone be corrupted but in a very small place, the periosteum there will never grow over it, but the parts adjoining to it and lying upon it will be irritated by an acrid sanious matter, from whence shall often arise very foul and incurable fistulæ; more especially if this circumstance occurs in such parts of the body, as have the bones covered with a large quantity of incumbent flesh, by which means it may not be easy to come at the part more immediately affected by incision with safety. If, for instance, the periosteum of the os femoris near the hip-joint should chance to be inflamed and suppurate, the difficulty of cure, and the mischiefs which may follow upon it, are evidently extremely great. Thus in a young gentleman, whom I visited, through the neglect of a deep inflammation in this part there was formed a sanious ulcer, which, forcing its way thro' the interstices of the muscles, though afterwards by repeated incisions a passage was opened in different places for the discharge of purulent matter, could notwithstanding never be cleansed; so that after a course of severe sufferings for several years, he died at last of a purulent consumption. As soon therefore as ever the diagnostic symptoms of this distemper appear, it will be adviseable to apply the most effectual means to carry off an inflammation of this kind by discussion; and thus to prevent, if possible, its coming to suppuration, which in these cases so frequently proves fatal; and more especially a gangrene.

4. All those remedies, therefore, which have been recommended in the cure of an inflammation capable of being discussed in §. 395, 396, 397, 398, 399, 400, are here to be immediately applied; and as the corruption of the bone which lies underneath is the cir-

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cumstance principally to be dreaded, we must use our utmost endeavours to draw the disorder towards the external parts. To this purpose the methods we recommended in §. 396, n^o 4. will more especially conduce: and therefore emollient fomentations and cataplasms should be constantly applied to the part affected, and care be taken to keep them always warm; for by this means the external integuments will grow flaccid, and the inflammation be sometimes derived towards the surface, which will be far less detrimental than if the bone that lay below were affected by it. When we come to treat of Acute Diseases, we shall give several instances, which will shew, that an inflammation lying deep may thus be drawn towards the external parts, to the great relief of the patient. It is an observation of Hippocrates, *In a quinsy, if a swelling and redness appear in the breast, it is a good sign; for the disease is diverted to the outward parts*^a. For which reason it is usual with skilful physicians to supple the external parts with emollient fomentations, and sometimes also to irritate with sinapisms; and frequently with good success. In a very troublesome sciatica (see the commentaries on §. 229, n^o 1.) Hippocrates advised to supple the part with baths, fomentations, and liniments; and in another place ordered^b cupping-glasses, to draw the pain towards the surface. And in a severe tooth-ach, it is usual to find ease from the pain immediately upon the swelling of the face on the side affected.

But when these applications have been tried in vain, and no relief obtained, all that can be done will be to open the part by incision quite down to the bone, if the condition of the place will admit of it. In a very sharp paronychia, which generally arises from an inflammation of the periosteum in the last joint of the finger, or of the tendon fastened to it, if an incision be not boldly made to the very bone, the bone becomes carious, and the joint falls off, after most excessive

^a Ab angina detento, si tumor et rubor in pectore oriantur, bonum; foras enim vertitur morbus. *Aphor.* 49. *sect.* vii. *Charter.* Tom. IX. p. 318. ^b De Locis in Homine, cap. 9. *Charter.* Tom. VII. p. 368.

cessive pains, being frequently attended with sinous ulcers, which prey upon all the adjoining parts, and by degrees render the whole hand stiff and unmoveable. All which mischiefs are capable of being prevented by an incision made in due time. If, in a sciatica, fomentations, baths, scarifications, &c. prove ineffectual, the ancient physicians have all advised the application of a caustic, which should eat deep into the part. And how advantageous it is to cut through the integuments of the cranium, where we have reason to apprehend the bone may be affected after wounds or contusions, we have already shewn in our account of Wounds in the Head.

§. 535. **T**HAT such an inflammation tends towards an imposthumation, we learn,
 1. From the signs of a violent inflammation having preceded, (534, n^o 2.) 2. From the throbbing, fever, and rigor. 3. From there being no signs of a discussion.

So long as there is any hope that an inflammation of the external periosteum may be cured by discussion, we are to pursue the rules laid down in the preceding paragraph. But when the case tends to a suppuration, other methods are required. And the following observations will shew us, when an abscess is to be expected.

1. There is cause to hope that a slight inflammation may be cured by discussion; but when all the symptoms are violent, and continually increasing, the best thing that can be desired is a suppuration. Great pain, excessive heat, and an acute fever, are the principal signs by which we know that such a deep inflammation cannot possibly be discussed, but tends towards an imposthumation.

2. When the inflammation has a tendency to suppurate, most of the symptoms usually grow more violent. The pulsation, therefore, will become greater, and be more distinctly perceived in the place affected: there

there will be likewise, for the most part, a fever; as this is a constant attendant upon a suppuration, if it be a case of any consequence. But the principal sign is a rigor or shivering in different parts of the body, which at all times gives cause to suspect the coming on of a suppuration, even though it shall lie concealed in the inmost parts of the body. The patient then feels, as if cold water was thrown all over him, almost precisely in the same manner as in the cold fit of an intermitting fever; only this shivering goes presently off, and by and by returns again in an irregular manner. These rigors, as we learn from observation, constantly occur whenever any inflammation of moment passes into a suppuration.

3. The signs of discussion have been explained in the paragraph referred to in the text. In these cases we may have hopes of discussion, if the disorder be recent, the pain gentle, the fever small, and there be a moderate perception of heat only in the part affected: And consequently under the opposite circumstances we shall have cause to apprehend an abscess or a gangrene.

§. 536. **T**HAT an abscess is actually formed, we learn from the signs of a suppuration lying deep under the surface, (387, 405.)

Unless it shall appear from preceding circumstances, that a violent inflammation has gone before, it will be no easy matter to discover the abscess following upon it. In an abscess which lies near the surface, the softness of the part, the fluctuation of the matter contained within, the whiteness, &c. are signs sufficiently evident, as we have shewn in the commentaries on §. 405. But where the seat of the disorder is about the bones, that are covered with a large quantity of flesh, there a latent abscess is not to be found out without great difficulty. For sometimes a small portion of matter collected between the bone and the periosteum shall cause no sensible tumour. It also frequently happens in this case, that the pain shall not remit, though there

there be matter actually formed : because, as it is gradually increasing, unless it has already eat through the periosteum, it will force itself a passage between that and the bone ; and so, by a slow dilaceration, separate the periosteum from the bone, and consequently excite a pain that is very intense. It is therefore by no means strange, that when the mischief lies thus deep, the most skilful of the profession should sometimes be mistaken, and not be able to find it out, till the bone be corrupted, or the purulent matter by breaking thro' the periosteum has diffused itself into the neighbouring places, and formed very foul sinuous ulcers. In case, however, the abscess lies near the spine of the tibia, it may be easily enough discovered. But in other places we have hardly any other rule whereby to judge that an abscess is actually formed, but that such signs have gone before as usually precede the formation of an abscess.

§. 537. **A**FTER this, the purulent matter, eating through the periosteum, will uncover the bone, rob it of its vessels, and soon corrupt it (531); compare §. 406.

In a suppuration, the vessels obstructed with an inflammatory matter that cannot be discussed are ruptured, as we have observed in §. 387. As therefore this happens also in a suppuration of the periosteum, all vital communication is taken away in that part of the bone lying underneath, which received its humours from the vessels now destroyed by the suppuration, and consequently the bone itself must of necessity be injured by it. Besides, the purulent matter lying deeper will by degrees grow more acrid, and erode the contiguous surface of the bone, and by this means quickly augment the violence of the disorder: and farther, as it increases in bulk, unless it bursts through the periosteum and spreads itself into the neighbouring parts, it will proceed to divide the periosteum from the bone, as we have already observed; and consequently

quently a larger portion of the bone will cease to be covered by its periosteum, and be corrupted. Besides which disorders incident to the bone from the suppuration of the periosteum, we have farther reason to apprehend all the ill consequences proceeding from matter lying long in a close place and corrupted, of which consult the commentaries on §. 406.

§. 538. **F**OR which reason the abscess is to be opened immediately, the matter to be let out, the ulcer to be cleansed, (403, 404, 409, 410, 411); and then the bone to be treated with the same cautionary rules, as were laid down in the case of wounds in the head, where the cranium was laid bare, (252, 253, 259, 260, 262, 266.)

To cure the present bad symptoms, and prevent the future inconveniencies, the only remedy left is to open the place, to let out the purulent matter, and give free access to the bone affected. It is frequently difficult indeed, and even dangerous, to make so deep an incision; but, as Celsus has well observed concerning the amputation of limbs, if it is the only remedy, we are not to desist from it though it be attended with danger^a. However, as in such cases both the reputation of the operator, and the life of the patient, are exposed to hazard, it will be adviseable to proceed with the utmost caution. Anatomy points out to us the situation of the large vessels, and of the other parts which ought to be avoided: yet we must observe, that the course of the vessels in different subjects is frequently very different; and therefore, in the most difficult cases, it is better first to cut through the cutis and fat, and then wait to see how far and by what means we may proceed with safety, than at once to carry the incision as far as to the bone. For it frequently happens, that, when the common integuments are cut through, the purulent matter shall burst the periosteum,

steum, and force itself a passage through the neighbouring places, and by this means direct us to a proper way of opening a sinuous ulcer with safety, and so coming at the place affected. The several particulars likewise concerning the cure of an abscess, which occur in the numbers referred to, are here to be observed. And as generally, in these cases, the course of the purulent matter lies through sinuous passages, and all places are foul where the said matter lodges, especially if it makes any stay, it is usual to inject mild detergents, and particularly such as are made from aloes, myrrh, mastich, sarcocolla, &c. with an addition of honey, turpentine, and the yolk of an egg; for these will answer the indication of cleansing the ulcer, and at the same time be of service to the affected bone. The several particulars also laid down, in the account of wounds in the head, concerning the cure of the cranium when divested of its pericranium, will have place in these cases, where the bone is laid bare after an abscess of the periosteum: And these may be found in the places referred to.

§. 539. **B**UT that the inflammation tends towards a gangrene of the part, we learn, 1. From the signs of a preceding violent inflammation; 2. From the ceasing of the pain in the part, without any good reason to be assigned for it; 3. From a thick, heavy, and almost un-painful tumour of the incumbent parts.

Speaking, in the account of an Inflammation, of its different manner of going off, we observed that it sometimes ended in a gangrene; and in §. 388, we described the symptoms whereby we might prognosticate its coming on, and distinguish it when present. Amongst these, however, there were some, which plainly point out to us a gangrene when situated in an external part of the body, that can be of no use to us in the discovery of a gangrene which lies deep in the periosteum. For the bladders of the scarf-skin, the
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livid, dark, and black hue, &c. are not discernible, except where every part is already mortified. At present, therefore, our business is, to treat of those signs by which we may know that the periosteum is gangrened, though the incumbent parts are not as yet affected.

1. The violence of an inflammation is known by the violence of the symptoms, and their sudden increase. And the principal signs of an inflammation in the periosteum, as we have observed in §. 534, n^o 2. are pain, heat, and a throbbing, felt to lie deep; which therefore, if they be very violent, and suddenly increase, give us great reason to apprehend a gangrene.

2. We have observed in §. 388. and §. 427, n^o 2. how deceitful a symptom it is to have the pain go away of a sudden in violent inflammations. And at the same time we gave the reasons, why, after the parts were destroyed by a violent inflammation, the pain should cease. The same reasons subsist here also. When an inflammation is cured by discussion, the pain grows less indeed, but leisurely and by degrees; nor will a good discussion ever follow a very violent inflammation, for the reasons given in §. 386. When, therefore, without being able to assign a good reason for it, that is, without the signs of discussion, the pain shall suddenly cease after a violent inflammation, it is the worst circumstance that can happen, and always indicates the succession of a gangrene.

3. The contagion next spreads through the incumbent parts, and particularly affects the panniculus adiposus, which frequently shall swell from very slight causes to a monstrous size. But as almost all the symptoms of inflammation go off when a gangrene once comes to be formed, this tumour will not have the hardness and renitency which we find in a phlegmon, but will be flaccid, and scarce painful; and constantly in this case points out to us, that the panniculus adiposus also is in like manner gangrened. Consult also what has been said in the commentaries on §. 427, n^o 4.

§. 540. **T**HAT a gangrene is actually formed, we learn both from the symptoms mentioned in §. 539. and also from the pale, cineritious, livid colour of the incumbent parts.

For when those signs, which point out to us the change of an inflammation of the periosteum into a gangrene, do either still remain or are increased, we have proof enough either that a gangrene is actually formed, or soon will be. And if the colour of the integuments be also changed, (of which see §. 388. and §. 427, n^o 3.) it shews clearly that the gangrene begun in the periosteum is already spread through the incumbent parts. *Ex osse ægrogante caro livida malum*^a; “where the bone is out of order, it is an ill sign if “the flesh turns livid.”

§. 541. **A**FTER this, the bone, being destitute of covering, and deprived of its vessels and their vital liquids, is, by the sharp, putrefied, gangrenous matter, converted into a caries, and the contagion increasing quickly spreads.

For when the periosteum is corrupted by a gangrene, all vital influx and efflux of humours is taken away in that place of the bone which was before defended by that part of the periosteum that is now corrupted, and consequently the outermost lamella of the bone will mortify. The intermediate vessels lying between this and the following lamella may indeed receive vital humours from the vessels of the internal periosteum dispersed through the substance of the bone, or from the vessels running between the lamellæ of the bone that are derived from the adjoining sound part of the external periosteum; but the mortified part lying upon them will extinguish the life that is in them, and the gangrenous filth of the parts that are dead will erode all around them, and by this means introduce a very bad caries in the bone. But when the bone and all upon it are in fact corrupted, there is then an actual

^a Hippoc. Aphor. 3. sect. vii. Charter. Tom. IX. p. 193.

tual sphacelation, as appears from the definition given of it in §. 419, 420. And when there is a sphacelus produced, the infection of the neighbouring parts will soon follow upon it, (see §. 432.) and consequently the reason appear why in this case the contagion will soon increase and spread.

§. 542. **T**HEREFORE the place affected is immediately to be laid open down to the bone, and to be cleansed, and the bone to be cured after the manner directed above (248, 249, 252, 258, 259, 260, 261, 262, 266.)

The only remaining hope of cure consists in this, that if there be any thing vital subsisting still in the substance of the bone, being freed from the mortified part which lies upon it, it may separate the parts that are corrupted, and renew the substance that is lost; or, in case the vessels through the whole thickness of the bone be all of them destroyed, by making an aperture in the bone a passage may be opened for the expurgation of the corrupted marrow. For it is impossible, in such a case, that the medullary substance should remain sound, whilst the substance of the bone is entirely lifeless. The latent mischief therefore ought to be immediately laid open, by making an incision quite down to the bone; nor will the operation be very severe, as all the incumbent parts are generally mortified. Celsus, therefore, when treating of the cure of this sort of disorders, very justly observes, *That it is above all things advisable to uncover the bone, by laying open the ulcer; and if the disorder extend farther than the breadth of the ulcer, then to cut away the flesh, till the sound part of the bone may be discernible on every side*^a. For if (as has been observed in §. 534, n^o 4.) an incision of the sound parts incumbent on the periosteum when inflamed be sometimes necessary to save the bone, it will be far more necessary to make a like

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^a Oportet autem, ante omnia, os nudare, ulcere exciso: et si latius ejus vitium est, quam ulcus fuit, carnem subsecare, donec undique os integrum patefiat. *Lib. viii. cap. 2. p. 508.*

incision when there is an actual gangrene and the bone itself is corrupted: For there can be no depuration of bone, unless the part be first laid open.

After the incision, very dry pledgets are laid between the lips of the wound, which lying till the next day, and imbibing the affluent humours, increase in bulk, and by this means enlarge the aperture, so that the bare bone may be visibly discerned, and a judgment formed from its colour and ruggedness of the nature and degree of its corruption. Consult upon this subject what has been said in the commentaries on §. 249. Hippocrates seems also to have approved of this method of cure. For treating of a sphacelation of the bone, he describes the corruption of the cranium, (as we have observed upon another occasion in the commentaries on §. 432.) and writes thus, *Where there is a tendency to sphacelation, a pain gradually seizes the fore-part of the head, which swells and grows livid, and is attended with a fever and shivering. In this case it is adviseable to make an incision in the part where it has swelled, and apply the raspatory,* ^b &c. In treating of wounds of the head, we gave an account of a very curious method by which the bone of the skull was slightly perforated with several small apertures, so as to open a passage for the subjacent vessels wherein there was life, and by this means separating the corrupted parts of the bone, and renewing the lost substance with greater ease and celerity; and it is plain, that this method may likewise be of use in the like diseases of other bones. . But in this case the success depends upon this circumstance, that the whole substance of the bone be not as yet corrupted, and that under the mortified part there be found vessels still subsisting. When therefore the bone, that is laid open by incision, is found to be entirely corrupted, ^c Celsus has advised the removal of the mortified part by incision or burning, and in this has been followed by the most eminent

^b Si sideratio invaserit, dolor paulatim anteriorem maxime capitis partem detinet, et intumescit, et livescit, febrisque ac rigor prehendit. Quum sic habuerit, secare oportet, qua parte tumerit, et os perpurgatam radere, &c. *De Morbis, lib. i. cap. 8. Charter. Tom. VII. p. 559.*
^c *Lib. viii. cap. 2. p. 509.*

surgeons. And yet how far nature is capable of acting of itself in these cases, when assisted with proper diet and convenient remedies, may be seen in that extraordinary case which we mentioned in the commentaries on §. 530. For the greatest part of the tibia was gradually cast off, and instead of it there afterwards grew up so firm a callus, that the girl was capable of walking, running, and dancing, without any detriment.

§. 543. **I**F the internal periosteum (522) be inflamed, as it has the same causes (534), so also on the inside of the bone the same effects; a like termination in an abscess or a gangrene (535, 539), but of a worse nature, as nothing can exhale from it; whence the whole medullary substance, and the entire bone, must be converted into filth and rottenness, and perish.

The internal periosteum, which covers the concave surface of the bone, and was spoken of in §. 522, is more safely defended than the external periosteum, and consequently is less subject to diseases. But as this membrane is also vascular, divers causes of inflammation may take place here, and of course the several events following upon it. And as the external periosteum distributes innumerable little vessels through the substance of the bones, and receives such as return from it; in like manner the internal periosteum seems to do so too. And as the disorders of the external periosteum do therefore more especially affect the bone, as by the destruction of these vessels the circulation of the vital humours through the substance of the bone is taken away, the same thing also will happen in the diseases of the internal periosteum; and consequently the internal surface of the bone will be capable of being corrupted, though the external part of it shall still continue sound. This seems to be confirmed by the observations of Ruyfch, which we spoke of in the commentaries on §. 522; for the bony pipe, contained within the cavity of the os cubiti, was entirely separated

ted from its external substance, and remained free and moveable. So that, as in the cranium the vessels of the pericranium supply the wants of the first table, and those of the second table are supplied by the vessels of the dura mater, the same circumstance does likewise occur in almost all the larger bones that have cavities within them; and as these small vessels of the pericranium and dura mater concur in the diploe, which lies between the two tables of the cranium, so possibly may something like this happen in the middle substance of the bones. Ruysch^a kept by him an os humeri, wherein was found an osseo-spongy substance between the two lamellæ, as in the diploe of the cranium; and this he affirms he has found in several bones, and thence explains the manner how such a bony pipe might be separated from the external part of the bone. The same author^b in another place has a resembling case, which confirms the notion we have here advanced. For a bony fragment, that was round and hollow, was by the force of nature thrown out of the os tibiæ, that had long been subject to a caries, whereof he has given us the figure in his tables. All the disorders therefore which are incident to the external periosteum from an inflammation, suppuration, or a gangrene, may likewise take place, if the internal periosteum may be affected with the same diseases. But if at the same time it be considered, that all the corruption arising from thence lies within the cavity of the bones, and that there is no way of carrying it off from thence, it is plain, that the diseases which happen to the internal periosteum are most to be dreaded; for the medullary substance will soon be corrupted, and all the disorders follow which have been enumerated in §. 526.

§. 544. **W**HENCE also it is manifest, that whether the membrane of itself be first inflamed, or whether the disorder proceed from an infection communicated by the medullary substance.

^a Thesaur. X. n^o 176. p. 69.

^b Mus. Anatom. p. 172. et Thesaur. VIII. n^o 8. Tab. iii. fig. 2, 3, 4.

stance being first corrupted, the same disease of a carious bone from the putrefied marrow will soon be the consequence, a disease which will scarce ever admit of a cure.

For the internal periosteum covers the concave surface of the bones, and is contiguous to the common membrane which surrounds the medullary cells. Whence it easily appears, that if the internal periosteum be inflamed, the medullary substance must soon be affected. For if this inflammation terminate in an abscess or a gangrene, it is evident, that the purulent or sanious matter cannot but erode the very tender contexture of the marrow; and therefore that it will soon be corrupted, and all the ill consequences follow which have been enumerated in §. 526. The difficulty of cure will appear from what we have observed in the commentaries on §. 528. Nor do I apprehend that any one can easily distinguish, whether the seat of the inflammation be in the membrane inclosing the marrow, or in the marrow itself, or in the internal periosteum; as all these cases are attended with the symptoms of an inflammation lying deep, and the pain is not increased by pressure; and as the effect also is the same, namely, a caries of the bone, and a putrefaction of the marrow. Whence also the same method of cure will be required, as we shall shew by and by.

§. 545. **T**HIS disease is known, whilst it yet continues within the bounds of an inflammation; 1. From the general signs of an inflammation (382). 2. From the depth of its situation. 3. From a blunt, fixed, long-continued pain, yielding to no external remedy; nor increased by the pressure of the hand: 4. Which, however, shall be augmented after a motion of the muscles.

As this disease is seldom discovered till very late, and after the appearance of its most terrible effects,
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those symptoms ought carefully to be inquired into by which it may be found out in the beginning, though this seems to be extremely difficult.

1. As most of the signs of an inflammation described in the number here referred to can only be observed in the outward parts of the body, the heat only, and the pain, with the fever which generally attends upon an inflammation if it rises to any height, can here be considered as the signs of this disease: For scarce any pulsation will be perceived in a place which lies so deep, and more especially as the vessels of the internal periosteum are very small.

2. If therefore these signs of an inflammation occur, and yet there be no appearance of disorder in the external parts, we have great reason to apprehend that the disease lies within the bones.

3. Persons in this state are apt to complain, that they feel their bones in a manner splitting from the inside outwardly. The pain continues fixed in one place; and though it be blunt indeed, yet is it extremely troublesome, as it admits of no mitigation, either from a change of posture, or from any fomentations, cataplasms, &c. and in the mean time is not augmented by being pressed upon, though in a rough manner. The reason of which is very evident from what we have already observed.

4. We have shewn, in the commentaries on §. 524, that the medullary oil may pass from the cavities of the bones into the cavities of the joints, where it serves to supple and lubricate the moveable extremities of the bones and ligaments, and may thus be consumed by an increase of the motions of the body. By this means therefore the liquids which stagnate in the cavities of the bones are drawn into motion, and such as move slowly have their celerity increased. If then there be any pain arising from an inflammation in the internal periosteum, or in the medullary membrane, it is plain that it must be increased by an acceleration of the motion of the humours through these parts. Such an increase of pain is constantly felt in this case by the patients from this cause, as also if they have at any

time

time over-heated themselves by a too plentiful use of wine or spices!

§. 546. **I**T is cured, 1. By the general method of cure required in every inflammation, (from 395 to 401); and then, as soon as ever the symptoms of discussion appear (386), 2. By a strict observance of the method directed in §. 529.

1. The cure of an inflammation by resolution is much the most desirable, and should always be attempted, (see §. 401); but in this case is hardly to be obtained. For it is seldom that in the first days of such a distemper any physician is consulted, as the blunt pain lying deep is apt to be either frequently neglected in the beginning, or endeavoured to be carried off by external applications, which are seldom of any service. But how very advantageous it is towards the discussion of an inflammation to have the case recent, we have shewn under §. 386. Besides, fomentations, frictions, baths, &c. which are so very serviceable in this way of curing an inflammation, can never reach the part affected: so that we have no other means left than to lessen the impetus and quantity of the arterial liquid by bleeding and cooling purges, to use a spare diet, and apply diluting and attenuating medicines.

2. If after the application of these remedies the symptoms of the inflammation, though they abate, do not entirely go off, we must not lay aside our endeavours, but try all that we can possibly do to perfect the cure. For the smallest circumstance of disorder in this case omitted may afterwards prove the occasion of very bad and frequently incurable diseases. And, therefore, though the inflammation be assuaged, it is notwithstanding advisable to pursue the method recommended under §. 529, in order to carry off the smallest relicks of the former disease. But as in this method, by replenishing the body well with decoctions

of the woods, an artificial fever is raised, it is plain that it ought not to be attempted till the cure of the inflammation has preceded, for otherwise worse consequences might ensue.

§. 547. **B**UT if either a suppuration or a gangrene follow; which is discovered by the violent symptoms (545) of a preceding inflammation, as also by a fixed, deep, blunt pain; either the method recommended in §. 529, or nothing, will effect a cure.

But when the remedies, proper for the cure of an inflammation by discussion, either have not been applied at all, or too late; or if the inflammation has been so violent, as not to give way to these remedies, though seasonably applied; the case must necessarily end in the other consequences of an inflammation, a suppuration or gangrene. And as there is no passage here for carrying off the purulent or gangrenous matter that shall be collected, the ill effects following are easily to be conceived. That these effects have taken place, we learn from the want of the proper signs of dispersion, and from the pain still remaining fixed, deep, and blunt. In this case the only hope of cure lies in the method described under §. 529, of carrying off the corrupted matter by ablution. But if this cannot be obtained, and the bone affected may safely be come at by incision of the incumbent parts, it is then to be perforated by the trepan quite through into the cavity, that by this means the corruption and sanious matter may be let out. That this has been sometimes done with good success, we have shewn under §. 530. A salivation, raised by mercury, has been several times attempted in these cases; but never, as I have seen, with any benefit: so that we may well suppose all other remedies must prove ineffectual.

§. 548. **F**OR then the whole mass of substance lying within the bone being putrefied,

fied, and the internal part of the bone itself tumefied, inflamed, and carious, the external periosteum becomes inflamed, is distended by the swelling, and eroded by the acrimony; the incumbent parts are corrupted by a slow contagion, grow spongy, tumefied, and painful; the whole limb perishes, and amputation alone is capable of giving relief.

For purulent matter retained in a warm place, will be attenuated, putrefied, and become acrimonious, (see §. 406.) And the matter of a gangrene, when once formed, will still sooner assume the most malignant disposition. The medullary oil, its containing vessels being corroded, will, when thus extravasated, stagnate, and acquire the highest degree of rancid acrimony; and thus in a short time the whole cavity of the bone will be filled with a very putrid and acrimonious sanies. In the case mentioned in the commentaries on §. 530, whilst the os tibiæ was perforating with the trepan, there issued out a very putrid sanious matter, and it plainly appeared that the whole medullary substance was corrupted. The concave surface of the bone will therefore be eroded by this acrid ichor, the vessels that lie between the lamellæ of the bone will be inflamed, the lamellæ which before were contiguous will be divided from each other, a tumour will arise in the substance of the bone, and the lamellæ at last be eroded. In the mean while, new pains will arise. For all the parts within the cavity of the affected bone being corrupted, the pain which was there before frequently ceases, or at least remains very languid: But when the external periosteum, which we know to be a very sensible membrane, begins to be distended by the swelling of the bone, or to be eroded by the acrimonious sanies approaching towards it, the torments of the disease then become exceedingly severe; the soft parts incumbent upon the bone begin then to be affected, and catch the slow contagion; and the tumours arising in these parts, and particularly

particularly in the panniculus adiposus, grow very large, but spongy, and yielding to the touch. Thus by degrees the mischief is propagated towards the external parts; all is corrupted, and the whole limb perishes: So that there being no longer any life either in the flesh or bone, a true sphacelus succeeds, which will admit of no cure but amputation. In very bad gangrenes, and the most violent contusions, though many of the parts be destroyed, there is almost always some hope left, that there are sound vessels remaining under the parts that are mortified, by means whereof the corrupted part may be cast off, and the loss repaired. But in this case the soft parts are not affected, unless the bone that lies underneath be first of all entirely corrupted.

§. 549. **A** VENEREAL, scorbutical, and rickety disposition, are frequently the cause; whence is understood what is meant by a gummi, tophe, node, exostosis, abscess, caries, and spina ventosa, in the bone.

For though an inflammation of the internal periosteum, of the membrane inclosing the marrow, and of the medullary bladders which contain the oil, may arise from almost every cause which is capable of producing an inflammation in other parts of the body; yet as these parts are so safely defended, it is seldom that an inflammation happens in them from the *common* causes. But it has been observed, that the bad disposition in the blood belonging to some diseases has a more peculiar tendency to fall upon the bones, and corrupt them. Of this kind, particularly, is a

Venereal taint.] It is certain, from very frequent observations, as will be shewn hereafter more at large in the account of the venereal disease, that this most subtle contagious matter, after it is mixed with the blood, is deposited in various parts of the body, and thus gradually erodes all around it; and at the same time is endued with the power of corrupting the sound humours,

humours, and so far converting them into its own nature, as to produce from them resembling disorders, not only in the neighbourhood of the affected, but also in more distant, parts. It will likewise hereafter appear, that this poison is more particularly apt to enwrap itself in the oily and mucous humours of our body; and therefore it will be the less strange, that it should join itself to the oleaginous matter, that is either dispersed through the substance of the bones, or collected in their cavities, and then by a slow erosion diffuse its usual corruption to every part. Of all the diseases incident to the bones, there are none more severe than such as are most frequently observed to proceed from a venereal cause; especially if the poison has lain long and taken deep root in the body, for it is seldom the bones are affected in a recent case. Then arise those very obstinate pains, which often give way to no remedies; and though sometimes mitigated after a salivation, or a course of the guaiacum drink, yet shall afterwards rage again. How the medullary substance of the bones itself has been corrupted by the venereal disease, has been shewn in the case mentioned in the commentaries on §. 530. And that the bones are often most severely affected by the same distemper, may be confirmed by innumerable testimonies of the most creditable authors. I myself have seen the ribs, the sternum, and the clavicles, eat through by it; I have seen the vertebræ of the neck eroded by a venereal ulcer, which seized upon the pharynx; and I have known the whole external table of the os bregmatis on the right side to have grown carious and been cast off, &c.: which may suffice to shew, that the diseases of the bones very frequently owe their original to the venereal distemper.

[Scorbutical.] The first symptoms of the scurvy generally shew themselves about the gums and teeth: and it is well known, that the teeth shall not only grow carious from this distemper, and fall out by bits; but the bony part of the jaw shall also suffer from it extremely. Those very stubborn ulcers of the legs, which are so common to scorbutical people, are frequently

attended with a caries of the bones. And in a very bad case of the scurvy, even all the bones have been ^a found carious. In a great number of soldiers, who died of this distemper, M. Petit ^b found the periosteum in several parts of the body entirely divided from the bones, with a brown, or rather blackish lymph lying under the periosteum, that was most intolerably fetid. From whence it sufficiently appears, how pernicious the scurvy is to the bones, especially where the case is inveterate; for then it is also attended with nocturnal pains in the bones, and several other symptoms in common with the venereal disease.

Rickets.] When we come to treat of the Rickets in a chapter by itself, we shall shew that this disease bears a great affinity to the scurvy, and frequently carries along with it the suspicion of a slight intermixture of a venereal taint; for it most frequently falls upon such children as are descended from parents who have been formerly subject to venereal illnesses and repeated gonorrhœa's. In this distemper, however, we find the bones to be very great sufferers: for the teeth turn black, grow carious, and drop out; the epiphyyses protuberate, and are easily separated from the bones to which they adhere; and if the distemper rises high, it is often attended with a caries of the bones, and a *tipina ventosa*.

From the aforesaid observations the following diseases of the bones are easily apprehended:

Gummi.] This name is usually given to a tumour, arising from the substance of the bone, of such a degree of tenacity and softness as yields to the pressure of the fingers, not unlike to that of gums distilling from trees, and concreted, either whilst they are exposed to the rays of the sun, or have not yet attained their utmost degree of hardness. Tumours of this kind are frequently seen in the heads of venereal people, as also in the middle and most solid part of the larger bones. These tumours seem to be formed, when the vessels running between the lamellæ, which constitute the

^a Acad. des Sciences, l'an 1699. Mem. p. 242.

^b Traite des Maladies des Os, Tom. II. p. 369.

the substance of the bone, are obstructed or inflamed, and being thereby dilated raise up the incumbent lamellæ. Possibly also in these tumours the very substance of the bone properly so called, though naturally so hard, degenerates into a preternatural and morbid softness. We learn from some surprising observations, that the compages of the bones may thus be softened frequently from latent causes. In the commentaries on §. 512, we observed from M. Petit, that the head of an os femoris and the cavity of the os ischium were converted into a fleshy substance, which would also bleed when slightly touched. And several other ^c cases are given by the same author, which clearly shew, that the bones are sometimes thus softened, though the cartilages wherewith they have been covered retained their natural hardness. In all these cases, however, the bones had lost their consistence in some particular places only; and yet we have one surprising instance to shew, that this circumstance may possibly become universal ^d. A woman of two and twenty years of age began after a fever to complain of violent pains all over her body; then, she grew unable to stand upon her feet; next she lost her shape, which had been a very good one; and at the same time so decreased in stature, that within nineteen months she was not so tall by a whole foot as she had been. The poor creature could not move from one place to another, but her bones bent under her. The whole body grew bloated, and the skin became both harder and thicker than usual; and yet she had an exceeding good appetite. After her death all her bones except her teeth were found to be softer than wax, and might be cut much easier than flesh. There was no cavity in them, nor the least appearance of marrow. Every other part of the body was in a natural state. It is plain, therefore, that in some diseases the bones may grow soft: and it has also been frequently observed at the same time, that the bones, when thus softened in some places from a topical disorder, have also been tumefied; which plain-

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^c Ibid. p. 420, &c. Académ. des Sciences, l'an 1722. Mem. p. 311.

^d Ibid. l'an 1700. Hist. p. 46, 47.

ly shew us, from whence these swellings take their rise.

It is farther evident, that this softness of the bones is sometimes consequent upon abscesses of the neighbouring parts; and sometimes originally arises from the substance of the bones itself, and especially when there is any venereal taint in the bone. And yet sometimes there has been a like disorder in the bones, when no cause could be assigned for it. And may we not sometimes impute this to an acid cacochymy of the blood? We see that weakly children, who live for the most part upon an acescent diet, and the strength of whose vessels and viscera is in the mean time insufficient to make a proper change in the chyle that is formed from their food, are frequently subject to the rickets, and too great a flexibility of the bones. When the liquid, in which Ruysch^e kept an human foetus, was made sharper than ordinary, the ribs became so soft, that he could not only bend them different ways, but could tie them in a knot like a cord.

Tophe, node.] When a harder tumour of this sort than a gummi rises in the bone, and yet softer than the bone itself to which it adheres, it is termed a *tophe* or a *node*. Boerhaave used to compare *tophes* to the horns of young cattle, whilst they lay under the skin; and *nodes* to the same horns, when they were just sprouting out, and had not yet attained to the hardness of horn. From whence it is plain, that a *tophe* and a *node* differ only from a *gummi* in a greater degree of firmness.

Exostosis.] This name is usually given to a tumour of the bones, which equals, or even exceeds, the bone itself in hardness. Sometimes the whole bone shall be increased in bulk in every part of it, and make the exostosis; as in the bones of the carpus and metacarpus, of the tarsus and metatarsus, and in the joints of the fingers. But this seldom happens in the larger bones, which have generally only some part of them raised up into such a kind of tumour. The nutrition and increase of the bones, and the restitution of their lost substance, whereof we have discoursed in the account

^e Ruysch. Thesaur. V. n^o 38. p. 17. Thes. VI. n^o 13. p. 11.

count of wounds in the head and fractures, sufficiently shew that the hard bony substance itself is capable of being renewed from sound humours conveyed in sound vessels in due quantity and with due force. It has also been frequently observed in the cure of fractures, that the callus which is formed, especially in younger persons, shall rise up above the surface of the other bone, and leave afterwards an hard and bony tumour, which shall last during life. But that substance, which unites and consolidates the broken bones, and restores the substance that is lost, is at first soft, and gradually acquires its bony hardness; see §. 294. If therefore the vessels, which convey the matter wherewith the bone is nourished, and its lost substance restored, be by any means dilated, there may thence arise an increase of bulk and a tumour in the bone itself. And as it is highly probable, that such vessels are distributed between the lamellæ, whose various strata make up the substance of the larger bones, (see the commentaries on §. 252.) both the bulk of the bone may be increased in these interstices, and the lamellæ be stretched out to a greater distance from each other, and thus the thickness of the bone be greatly augmented.

Now as these tumours in the bones protuberate either towards the external or internal parts, according to the different place of the bone they possess, the diversity of the neighbouring parts which are disordered by them, and lastly according to their different bulk and figure, we learn from the history of physic, that divers disorders may arise in the human body, and frequently very surprising ones.

Ruyfch^f divided part of an os tibiæ, affected with an exostosis, longitudinally; and then found a cavernous exostosis on the inside of the bone, which contracted the cavity of the marrow. The many disorders arising from such an exostosis are extremely evident, as the marrow must be thereby compressed and injured, and in consequence thereof all the inconveniences may be apprehended which have been reckoned up in §. 526. The exostoses which are formed in the middle and
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^f Thesaur. X. n^o 178. tab. ii. fig. 4, 5.

most solid parts of the bones, are generally very hard in every part of them; but those which lie near the joints are sometimes only externally hard, and under this incrustation surprising changes of the soft parts, lying between the separated bony lamellæ, into fungous flesh, purulent and sanious matter, mucus, &c. have been observed ^a. If the inside of the cranium was to be raised into a like tumour, it is evident, that we should have cause to apprehend an epilepsy, palsy, apoplexy, &c. might ensue from the pressure upon the brain. And yet there was a soldier, who had an external exostosis in the temporal bone, and bore it without any great trouble for near fifteen years, though it gradually increased in bulk, till it grew to be as big as a small melon; and when after his death, which followed upon his being cut for the stone, this exostosis was divided ^b, it was found in the inside to be as hard and as white as ivory. But as exostoses, rising on the outside of the bones, must necessarily distend by degrees the incumbent periosteum, very troublesome and lasting pains will sometimes follow from thence, and such as are exceeding sharp; but yet will cease the sooner, if the exostosis be pointed. M. Petit ⁱ saw an exostosis arising from the os. tibiæ, which resembled the processus styloides, rising above the surface of the bone the length of four geometrical lines, which in the beginning was attended with very sharp pains, that gradually decreased, and at last went entirely off, leaving the bony tumour quite indolent.

These bony tumours are sometimes apt to follow external injuries; and are likewise observed to rise from internal causes, and never more frequently than from the venereal disease: The very bad ulcers in the legs of scorbutical people, which are so very hard to cure, are often attended with a caries of the bones, and sometimes with an exostosis. Exostoses from external causes are generally of a milder nature, though always difficult to be cured; and such as are owing to internal causes, do sometimes give way to the cure of the disease.

^a Petit Traite des Maladies des Os, Tom. II. p. 358, 388. ^b Ibid. p. 381. ⁱ Ibid. p. 436.

eases from whence they spring, or at least are very much lessened, as has frequently been observed to be the case in such as are venereal. Exostoses may also arise from slight contusions, especially in those places where the bones lie high and have no great quantity of flesh to cover them; for which reason they are so often found in the spine of the *tibia*; and as this part lies so much exposed to frequent injuries, M. Petit^k has taken notice, that there are few men who have not some inequality in the surface of this bone. But how exceeding large the bony tumours are which sometimes follow upon violent contusions, may be seen from the following case.

^l There was a young man of sixteen years of age, who when he was six years old received a violent contusion in his left hand, which was then thought to have been perfectly well cured. However, within a short time after, the hand began to swell, and grew gradually bigger for ten years together, but more particularly for the last two years the increase was very considerable. We may judge of the bulk of it by the weight, which amounted to six pounds. Being cut off above the joint of the wrist, it appeared, that the thumb and the index were both unhurt, but the joints of the other fingers were extended to an excessive bigness, and made three distinct exostoses, whereof the largest was about seven inches in diameter, the next six, and the other four.

Exostoses arising from external injuries are seldom cured unless they are capable of being removed by manual operation; but as they are generally of a mild nature, few people are willing to submit to a cure, (which is often dangerous, and always difficult), unless they offend very much by their bulk, figure, or situation.

Exostoses arising from internal causes are often cured by a removal of the cause, or at least are very much decreased in bulk; or in case they remain after the diseases from whence they spring are healed, which sometimes happens when the cause is venereal, if any great mischief be apprehended from them, they may be taken

^k Traite des Maladies des Os, Tom. II. p. 435.
des Sciences, l'an. 1720. Mem. p. 582, &c.

^l Acad.

ken away by incision or burning, after the integuments have been laid open; and yet I have seen several cases, where the exostoses have remained after the cure of the venereal disease for several years without any other inconvenience than barely their deformity. The best method of taking off these bony tumours may be seen in the author^m lately quoted.

Abcesses.] What is meant by this name in the soft parts of the body, has been explained in the commentaries on §. 402; and we have shewn in §. 516, that the bones are liable to the like diseases. It is farther plain, from several of the observations recited in this chapter, that an inflammation formed in the cellular part of the bones near the joints, and in the middle of the cavities of the larger bones, has passed into an abscess. Besides, the very substance of the bone properly so called is said to abscede, when one or more of the lamellæ, whereof the bones consist, being mortified and corrupted, is loosened and disjoined from the sound vessels which lie under it; and then a like substance with these disjoined lamellæ is generated afresh, which is again covered over with a new periosteum, and thus the whole of what is lost was perfectly restored. Consult what has been said upon this subject in the commentaries on §. 252; where it was observed at the same time, that Hippocrates, treating of wounds in the head, had taken notice, that the bone laid bare, or the impression of the wounding instrument left in the bone, frequently absceded from the other part of the bone wherein there was life and blood. And may we not refer to abscesses of the bone those wonderful cases recorded by Ruysch, whereof mention has been made under §. 522, 543. in which a round bony pipe was found separated from the other bone in the midst of the cavity of the larger bones?

Caries.] A much more grievous disorder, and entirely distinct from an abscess of the bones. For when the bone abscedes, it still retains the cohesion of its parts, and for the most part is separated in the form of a thin plate. But, in a caries, the substance of the bone

bone is so corrupted and eat into, as to be converted into dust. This therefore denotes a much greater corruption of the bone, and a more difficult cure. How to distinguish a caries of a bone, when covered with the common integuments and muscular flesh, will be shewn in §. 553. But when it is exposed to the eye, or can be touched with a probe, it is easily discerned. Whence that observation of Celsus, *In a caries, a judgment is easily to be formed; for if a small probe be thrust into the cavity, by the degree of its admission you may know whether the caries be deep or superficialⁿ.* For where the bone is grown carious, it has scarce any solidity, and gives way to the probe; but when the probe is carried quite to the sound part of the bone, it there meets with resistance. Whence Celsus, after directing the bones to be rasped as necessary to the cure, adds, *You must leave off, when you come to the white or solid part of the bone: the whiteness plainly shews where the disorder ends, all that is vitiated being black; and the solidity shews the extent of the caries o.*

Spina ventosa.] Which is a caries of the worst sort, when the medullary substance, corrupted by an internal cause, erodes the bone. See what has been said upon this subject towards the close of §. 526.

§. 550. **H**ENCE we know, why a carious bone doth so variously change its colour, from a blueish white to the colour of fat, yellow, cineritious, livid, black; and the several degrees of corruption denoted by each of them.

When, in discoursing of wounds in the head, we treated of the signs whereby we might discover the ill state of the cranium, (see §. 249, 262.) it was observed, that the colour of the sound bone in a living man was
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ⁿ In carie quidem expedita cognitio est, si specillum tenue in foramina demittitur, quod magis minutive intrando, vel in summo cariem esse, vel altius descendisse, testatur. *Lib. viii. cap. 2. p. 508.*

^o Finis est, cum vel ad album os, vel ad solidum, ventum est. Albo finiri ex nigritie vitium, soliditate quadam ex carie, manifestum est. *Lib. vii. cap. 2. p. 508.*

inclined to red and blue; and that the first sign of its being vitiated was its change of colour to white, yellow, brown, and black. The same observation holds good in all the other bones, and in general the degree of corruption is greater in proportion as the bones decline from their natural colour towards blackness. The first change of colour is when the bone turns white, which denotes a kind of beginning death in the bone; whence also, when the cranium thus affected was perforated with very small terebræ after the manner commended by M. Belloste, the first sign of a successful cure was the white surface of the bone beginning to grow red. And since, as we have shewn in the commentaries on §. 524, the medullary oil passes through the pores of the incumbent lamellæ as far as the external surface of the bone, and possibly may be there received by the small veins of the periosteum and mixed with the blood, it is plain, that if the vital fabric of the bone be destroyed, the oil conveyed thither must be accumulated, stagnate, and be corrupted, and consequently the bone will grow fattish and yellow. This circumstance is well taken notice of by Celsus, who treating of the disorders of the bones says, *The faulty part of the bone first grows fattish, and then turns either black or carious*^a. As the mischief increases, the colour becomes cineritious; then livid; and at last black, indicating the bone to be absolutely dead, and that it has attained the highest degree of corruption. This successive change of colours is likewise observed in the teeth, when they begin to decay; for they first turn yellow, then brown, then black, and at length grown carious they fall to pieces.

§. 551. **H**ENCE also the reason is evident, why a carious bone becomes uneven, rough, spongy, friable, soft, and brittle: The external and internal arteries no longer press upon the lamellæ of the bone.

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^a Id quod vitiatum est, primo fere pingue fit, dein vel nigrum, vel cariosum, &c. Lib. viii. cap. 2. p. 508.

From what has been said in the first five paragraphs of this chapter, it is plain, that the bones consist of lamellæ lying upon each other, having small vessels passing between them, which convey the vital humours that are necessary to sustain the life and nourishment of the bones, and more especially in that part of the bones where the vacuities between these lamellæ are largest. The little arteries, therefore, that pass between the exterior lamella of the bone, and the lamella that lies directly underneath it, when in their diastole, endeavour to raise up the exterior lamella in almost every point of it. But the arteries dispersed through the periosteum, when dilated, resist the elevation of this lamella with an equal or a greater force. When, therefore, the periosteum is by any means corrupted, the action of the arteries passing between the lamellæ will prevail, and the exterior lamella be raised up; and the same thing may plainly happen in all the other vacuities that are interspersed between the several lamellæ of the bone: and though the action of these little arteries may perhaps seem so small, as to be incapable of raising up a hard bony lamella, and dividing it from the lamellæ below; yet if it be considered, that their action upon almost every point of such a lamella is repeated four thousand times in the space of every hour, it may possibly not seem so strange that such effects should be produced by a small force so frequently applied. When, in wounds of the head, the surface of the skull, divested of its pericranium, has been injured by being exposed to the air, the application of fat substances, &c. frequently within a few days the corrupted scale has been cast off by the force of these little arteries; as has been shewn more at large in the commentaries on §. 249.

The reason therefore is evident, why the internal arteries, or such as pass between the lamellæ, raise them up externally, whenever the pressure of the arteries which are capable of acting upon the external surface of these lamellæ fails. The bone, therefore, which is corrupted, for this reason has an uneven surface, and becomes rough, and, as the lamellæ thus

recede to a greater distance from each other, becomes spongy and brittle, and loses much of its natural solidity. For, in sound bones, the part where the lamellæ are contiguous is the firmest, which generally is in the middle of the larger bones; and, on the other hand, the bones are more spongy, soft, and brittle, at their extremities, where the lamellæ lie at a greater distance from each other. But carious bones are therefore more friable, as their substance is eroded by the humours, which stagnate, and thereby grow more acrimonious, and especially the corrupted medullary oil, as has been shewn in §. 526. Besides, the cohesion of the bones seems to depend upon the oil, which like glue is interposed between their earthy particles: for the bones become very brittle, as we have before observed, when deprived of their oily substance by burning; and yet when rendered thus brittle by a long calcination, if dipped again in oil, will obtain a firmer cohesion. As therefore the oil, when attenuated by putrefaction, flies off, and the bone is at the same time eroded by sharp humours, the reason plainly appears, why carious bones are so very friable, that upon the slightest touch of a probe they shall crumble to pieces.

§. 552. **A**S also, why a stench exhales from it resembling the smell of rancid lard.

This fetid smell is so very particular, that from it alone a skilful surgeon will presume to form a prognostic that the bone under the ulcer is carious. It is highly convenient, therefore, to become acquainted with it; though it is so bad as to exceed all description, but yet comes nearest to the abominable smell of corrupted and rancid lard. When the caries has reached the medullary substance, the reason of this stench is evident enough; but we even find it when the corruption of the bone is only superficial. In the commentaries upon §. 524, we observed, that the medullary oil passes through the pores of the lamellæ, and is conveyed along the interstices of the lamellæ to
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the external surface of the bone; though therefore only the external lamellæ become carious, the medullary oil conveyed thither will stagnate, be corrupted, and emit this most fetid smell.

§. 553. **A**ND why, in a place ulcerated from a caries lying underneath, the superincumbent flesh is soft, flaccid, fungous, bloated, and swelled; the lips of the ulcer inverted; the sanious matter clear, thin, scarce glutinous, fetid, and filled with little black scales; and why the sore shall break out again without cause, and obstinately hold out against all the remedies that are most successful in the cure of all other ulcers.

We have now under consideration the several symptoms which usually attend a caries of the bone, and which when present point out frequently to a skilful surgeon the disorder that before lay undiscovered.

Why in a place ulcerated, &c.] When, the bone being first affected and corrupted, the incumbent parts are also affected and ulcerated, they are generally thus gradually preyed upon, and raised into a soft and flaccid tumour, as the surgeons constantly experience, and is visible in a spina ventosa, which seems to have had its name from thence. For the rottenness of the bone, which lies underneath, spreads the filthy contagion through all the neighbouring parts: and as the panniculus adiposus is so easily apt to swell, it soon grows bloated, though not with that hardness that attends an inflammatory swelling; but is soft and flaccid, and, when pressed by the fingers, has a kind of wavering motion. For which reason surgeons of judgment, when they examine old ulcers, always endeavour to find out by their fingers whether all is firm around the circumference of the ulcerated place. For the incumbent parts do not adhere to the bone, when it is corrupted; nor can they be brought by any art to grow to it, until the corrupted part be first cast off. When the teeth are carious, the gums fall from them, nor

will they ever after cleave to the carious place. In the commentaries on §. 549, we observed, that the periosteum did not cohere to the bones affected in a very bad scorbutical case; but, upon opening the bodies, was found to be loosened from them. So, in a wound of the head, the cranium was known to be affected by the separation of the flesh from it about the seventh day, the pain, the thin ill-smelling ichor issuing from it, and the uncommon malignity of the wound, (see §. 255, n^o 8.) Possibly also the elastic matter, which is usually generated by putrefaction, may increase the swelling of the incumbent parts.

The lips of the ulcer inverted.] In §. 158, treating of the appearances which happen to a wound in a sound and robust body, we asserted that the lips of a wound were turned back, from the rising up of the panniculus adiposus when freed from the confinement of the skin which covered it. For the same reason, the lips of a like ulcer will be inverted by an inflation of the panniculus adiposus. But in a wound the lips are tinged with a lively red; whereas in these ulcers they are foul, pale, and frequently livid; and, as Hippocrates has well expressed it, when speaking of wounds in the head attended with a corruption of the bone, (see §. 255, n^o 8.) they look like flesh when it is salted.

The sanious matter clear, &c.] Treating of suppuration in §. 387, we observed that Hippocrates and Galen sometimes expressed it by the word *putrefaction*. Yet they very justly distinguished a suppuration from *putrefaction* properly so called: for in the one, they said that nature was the conqueror; and in the other, that nature was conquered. Whence Galen rightly concluded, as in the passage there quoted, that a suppuration was not merely a putrefaction, but was attended with some degree of concoction; and that the humours, which otherwise would putrefy, were converted into purulent matter by the surviving faculty of the vessels. He farther adds, that the liquid in ulcers degenerates more or less from the conditions of laudable matter, as the concocting powers are stronger

stronger or weaker, and the matter to be converted into pus is more or less stubborn. As, therefore, in an ulcer attended with a caries of the bone, the putrefaction from the corrupted oil is extremely bad; and both the incumbent and adjoining parts are flaccid, soft, and inflated, and often almost half-gangrened; it is plain, that both the matter to be converted into pus is of a stubborn nature, and the concocting powers exceedingly weak. No wonder, therefore, if instead of laudable pus, which is the work of nature when she is conqueror, and is white, thick, smooth, uniform, and without smell, we should have here a thin, fetid, sanious matter, sometimes brown, and always very acrid. With this sanies are usually discharged small black scales of corrupted bones, which the surgeons justly look upon as the surest mark of a bone's being carious. For the same reason, in ulcers of long standing, they are always careful in their dressings to examine the pledgets and plasters; and if any blackness be seen upon them, or any fetid smell perceived, they then suspect the bone to be carious.

Why the sore shall break out again, &c.] For unless the affected bone could be thoroughly cleansed, the matter of the disease will still be left behind; and though the ulcer be closed, it will constantly break out again. Nor do such ulcers ever cicatrize firmly, but the cicatrix will always appear soft, elevated, and moveable, and sooner or later the place will afterwards be spontaneously opened. When the teeth rot in their sockets and grow carious, there commonly arises a sudden inflammation in the gums, which is followed by a suppuration: upon opening the abscess, a very fetid pus shall be let out, and the disorder seem to be cured; and yet within a few weeks after, unless the tooth be pulled out, and the place affected cleansed, and by this means the cure perfected, the complaint will usually return. Thus I have seen a very stubborn ulcer in the forehead of a boy, who, after the small-pox, had boils breaking out upon him in divers parts of the body, which by the application of desiccatives seemed more than once to be healed up,

and yet afterwards broke out again ; till at last, full two years after, a scale of the corrupted bone was separated, and then within a few days it was perfectly healed.

Obstinately hold out, &c.] No ulcer can be perfectly cured, unless it be first brought to the condition of a pure wound. For if there be any thing dead or corrupted in the ulcer, it is an heterogeneous body, which will constantly hinder the union of the separated parts so long as it continues there. In the history of wounds (§. 206, 207, 208) we gave an account of the several methods and most powerful applications for carrying off any such fordes so lodged. And yet the surgeons have often been troubled to find, that, with all their applications, they have gained little ground in some ulcers, which seemed not to be of any great consequence ; and in this case they have almost constantly found, that the bone has been carious underneath. This Hippocrates has taken notice of in his aphorisms : *If an ulcer be of a year's standing or upwards, it will require an exfoliation of the bone* ^a. And sometimes these disorders of the bones are so stubborn, as to yield to no remedies. When the os calcis is corrupted, Hippocrates ^b says, the disease will last an age.

§. 554. **A**S also, why a caries from an external cause is easily cured, from an internal cause with difficulty, from the venereal disease with still greater difficulty, and from a spina ventosa with the greatest difficulty of all.

According to the diversity of the cause producing the caries, the greater or less difficulty in the cure is foreseen. For if it has arisen from an external cause, a contusion (for instance), or a wound, only part of the bone is thus corrupted ; and the sound humours conveyed through sound vessels to the rest of the bone, will

^a Ulcera annua quæcunque fuerint, aut longius tempus habuerint, os abscedere et cicatrices cavas fieri necesse est. *Señ. vi. Aphor. 45. Charter. Tom. IX. p. 277.*

^b De Fracturis. Charter. Tom. XII. p. 200.

will be able to throw off the corrupted part, and restore the substance that is lost. For that reason, in wounds of the head, the caries of the skull is frequently so well and so soon cured; provided the body be sound in other respects. But when the humours, which flow through the substance of the bones, have by means of a morbid acrimony eroded them, it is plain that the cure will be more difficult, as the same cause which first produced the disease is frequently still remaining after the carious place has been cleansed. And the greater difficulty there is in correcting this acrimony, the more difficult the cure will be. And as the contagion in the venereal disease, when once it is got into the bones, is not to be carried off without great difficulty; and frequently, after long courses of Mercury and the guaiacum drinks, the distemper shall break out again with equal malignity, tho' there have been no signs of it for several months before; it is evident, that the cure of a caries arising from this cause must necessarily be attended with still greater difficulty. In a *spina ventosa*, the caries of the bone, as we have observed in §. 526, arises from a prior corruption of the medullary substance, and therefore seldom appears till after the entire substance of the bone has been eroded; in such a case, therefore, there is no vital power remaining under the caries sufficient to throw off the parts that are corrupted, or restore the parts that are lost. All the hope left is, that great part of the corrupted bone may be taken away by art, or that, after a course of months or years, it may spontaneously fall off from the sound bone adjoining to it. That this has sometimes been the case, appears from the observations above related; but it appeared also from the same observations, that the cure of this disease is of all others the most difficult.

§. 555. **L**ASTLY, why a caries in the solid part of the bone is bad, in the spongy part worse, and in the joints worst of all; why the first is slow, the second quick, and the last the quick-

quickest of all; why in children it gains ground apace, and is hard to cure; and why the spina ventosa generally shews itself in different places, either at once, or successively.

In the commentaries on §. 516. we shewed, that the middle part of the larger bones was the most compact, and less vascular; and that the bony lamellæ lay at a greater distance from each other, and had greater vacuities between them, in proportion as they advanced nearer to the extremities of the bones, which vacuities abounded with a considerable number of small vessels and vesicles filled with a very thin medullary oil, (see §. 518.) At the same time we shewed also, that a like cavernous substance was in a more particular manner to be found in that part of the bones which forms the joints, and is covered with a ligamentary purse that ties the said joints together; and that this substance was covered with so thin a shell of bone, that in the os femoris itself it frequently did not exceed the thickness of a man's nail. If therefore a caries occur in the most solid part of the bone, it will be a bad circumstance indeed; but yet there is reason to hope, that a separation of the carious part may be obtained; nor will the substance of the bone, which is here very firm, be so soon eroded. But when a caries is formed in the spongy part of the bone, the thin bony shell will soon be destroyed, and the parts underneath corrupted; from whence will follow a very bad putrefaction, and, what we have still more to fear, a corruption of the medullary oil. And as the substance of the bone near the joints is still thinner than in any other place, and the number of vesicles containing the medullary oil greater; if these parts be affected, the ill consequences will be still greater. And if at the same time we consider, that from an erosion of the surface of the bone the putrid sanies here collected must fall into the cavity of the joint, we shall plainly discern, why a caries in this part is attended with such terrible disorders, as will scarce ever admit of a cure, but by the amputation of the limb. A very extraordinary case of
this

this kind is described by M. Mery^a, which plainly shews us, how far the fabric of the bones is capable of being altered in this cavernous part which lies near the joints. A soldier had the condyli of the os femoris, by which it is articulated to the tibia, expanded to so enormous a bulk, that all the incumbent parts labouring under excessive pain from the violence of the distension, the poor wretch most earnestly desired that the limb might be cut off. When this was done, the tumefied condyli were dissected; and, when divested of all their incumbent parts, they weighed eleven pounds: they made a kind of bony globe, which was hollow on the inside, and filled with a polypous matter and a yellow limpid sanies.

From hence also we see, why a caries preys more slowly upon the solid and dense part of the bones, swifter upon the spongy part, and most swiftly upon the cavernous substance which forms the articulated extremities of the larger bones.

But as the diseases occurring in that part of the bones which abounds most with vessels, and of course approaches nearest to the nature of the soft parts (see §. 515.) are both most numerous and most difficult, the reason is plain, why a caries of the bones in children both makes a swift progress, and is hard to cure. For in childhood the number of vessels is greater in every part of the body, several of which as we grow up are gradually destroyed, and losing their liquids have their sides grow together, (see §. 43, n^o 4.) whence of course the number of vessels in the bones of children will be the greater, and their substance softer, and consequently they will be liable to be both more easily injured, and sooner corrupted. It has farther been found, by universal experience, that a spina ventosa, or caries of the bones, arising from a prior corruption of the medullary substance from an internal cause, is seldom or never confined to a single place only, but generally seizes upon divers parts, and frequently such as lie at a considerable distance from each other. Thus I have known a spina ventosa first in the middle joint
of

^a Acad. des Sciences, l'an 1706. Mem. p. 318.

of the index finger, and within a few weeks after in the tarsus of the foot, and in the os jugale; which after a tedious time has been cured by a separation of part of the corrupted bone, and left a very deep and ugly scar behind it. Whence also we see, that we should not too suddenly proceed to the extirpation of the part affected, as the disorder is so apt to shew itself again in other places. And the reason seems to be this. A spina ventosa owes its original to internal causes, (see §. 526.) and most commonly to a venereal, scorbutical, or rickety, disposition; which is generally not deposited upon one place only, but upon several. Add to this, that the disorder produced in any one place may infect the sound humours that shall pass through it, and by this means be propagated through the whole body; as is more especially seen in the venereal disease, where the mischief for the most part begins in the genital organs, and is thence conveyed through the whole corporeal system.

§. 556. **W**HOWER adds to these (from 512, to 556.) what has been said of a contusion (325.) of a luxation (from 358, to 370.) and of fractures (from 339, to 358.) as also what has been said of wounds in the head, where the bone has been injured (from 249, to 297.) will have the history of the principal diseases incident to the bones, and the proper method of curing them. Especially if to these be added an ankylosis, which is an immobility of the articulation attended with a hard tumour; and owes its rise more particularly to the callus of a bone broke near the joint, to an inspissation of the liniment of Havers, to a stiffness in the ligaments, or an exostosis near the joints. The cure is exceeding difficult, and must be taken from the difference of the cause.

From what we have already discoursed in this chapter, the principal diseases incident to the bones may be

be understood; especially if we add to them what has been said, upon another occasion, concerning the disorders incident to the bones from wounds, contusions, luxations, and fractures. For in the account of a Contusion given in §. 325, the several ill consequences are enumerated which usually follow upon contusions of the bones: And in the chapters concerning Fractures and Luxations, there are many observations relating to the diseases of the bones. We shewed also, in treating of wounds in the Head, that the bone of the skull was frequently a great sufferer from very slight wounds; and at the same time laid down several curious matters concerning the knowledge and cure of diseases in the bones. However, we think it requisite to add still something farther concerning an ancylosis, as it frequently arises from the fault of the bone; though it may proceed from another cause, as when the ligaments of the joints grow stiff, or when there is an inspissation and accumulation of that liniment which lubricates the extremities of the articulated bones, and the ligaments that strengthen the articulations.

In the commentaries on §. 364. (where we treated of an Ancylosis, so far as it is found to be the consequence of a Luxation), we observed from Celsus, that contractions of the joints by a recent cicatrix were termed by the Greeks *αγκυλας*; and that *Ægineta* called the detensions of the joints *αγκυλας* and *αγκυλωσεις*, and ascribed them to an obstruction of the humours, or a contraction of the nerves. We shall see presently, that this disorder may arise also from the fault of the bones. It seems to be rightly defined, *An immobility of the articulation, attended with an hard tumour*. When this disorder proceeds from too large a callus of the broken bones, or an exostosis near the joint, it is plain that there must be also a hard swelling. But when it arises from the stiffness of the ligaments, or the inspissation of Havers's liniment, this liniment cannot but be gradually accumulated in the cavity of the joint, as it is not carried off by the motion of the joint, and consequently it will distend the capsula of the joint, and cause a tumour to arise, which in time will grow
hard

hard as the thinner part of the accumulated liquids flies off. And thus an hard tumour is for these reasons apt to accompany an immobility of the joints, or at least to follow upon it, if it does not shew itself in the beginning. And yet one case, which I have seen, may be excepted, where the whole arm was dried up with a true marasmus, in which state the joints of the limb were all immoveable without any swelling. For to give a due mobility to the joint, there is required a proper figure in the articulated bones, a just degree of smoothness in the surfaces which are contiguous, and also a proper flexibility of the ligaments which surround them. And therefore an ancylosis arises from the following causes:

From the callus of a bone broken near the joint.] In the commentaries on §. 343. we observed, that after fractures, there followed a luxuriance of the bony vessels, and an inequality of callus, which deformed the natural shape of the bones; and we shewed, that, in several cases, such an ill-shaped protuberance from too large a quantity of callus has been left in the place of the fracture for the remainder of life. If, therefore, the fracture be near the joint, it is plain that the joint may thereby become immoveable from the alteration of shape in the bones. It is true indeed, that in most of the joints the extremities of the articulated bones are safely guarded by a covering of many incumbent parts, and therefore can hardly be broken in the part contained within the cavity of the joint: yet in some places they lie greatly exposed, as for instance about the elbow and the knee; and there an ancylosis may be formed from this cause. Thus M. Petit^a takes notice of an ancylosis which he saw from a luxuriant callus upon a broken rotula; which yet was afterwards cured, because the substance of the callus had not then acquired the hardness of a bone. When the surgeons are apprehensive of an ancylosis in such a case, they order the affected part to be so disposed, as to divert the luxuriating callus by its own weight to another place; they then lay bolsters between the joint and the fractured

^a Traite des Maladies des Os, Tom. I. p. 397.

fractured place, which being kept on by a slight bandage prevent the callus from running towards the joint: after this they cause the joint to be gently moved, when the first dressings are taken off; and continue this practice every other day at the beginning, and then every day. Nor will there be any great cause to fear that the bones reduced should be hereby thrown out of their proper situation, provided the joint be moved with caution; for as the bones are broad near the joints, the surfaces of the broken parts will be so large where they are united, that they will not easily be moved from their place. M. Petit^b got the better of an ancylosis, after it was actually formed from this cause, by barely moving the joint in the manner above described.

An inspissation of the liniment of Havers.] To facilitate their motion, and prevent their being injured by their mutual attrition, the extremities of the articulated bones are lubricated with a very smooth liniment, which generally bears the name of Havers, from the accurate description which that learned gentleman, to whom we owe so many beautiful discoveries concerning the structure of the bones, first gave of its nature and component parts; and yet Hippocrates has said, (see the commentaries on §. 362.) that all the joints have naturally a mucus, and are then sound when this mucus is uncorrupted. This liniment of the joints consists of three distinct liquids, (see §. 362); the liquid universally perspiring, the medullary oil, and a mucilage secreted from the glands which are situated here. If therefore this liquid be not by some means or other carried off, or taken up again, it will by degrees be accumulated and fill up the cavity of the joint, and thereby interrupt the motion of the articulated bones; in the mean time the thinnest part of it will fly off, and the remainder grow thicker; and as the motion of the joint is the principal cause of consuming this liniment after it has discharged its office, if this be impeded or entirely ceases, it will be accumulated in a still greater quantity, and the disorder become incurable,

rable, partly from the inspissated matter, and partly from the acrimony it will acquire by stagnating, whereby it will in time erode and corrupt both the very smooth cartilaginous surfaces of the bones, and also the ligaments which fasten the joint.

This disorder is distinguished by a tumour, which at first is soft, and gradually increases, lying within the joint, and never extending itself beyond it. It more frequently affects the knee than any other joint.

Hippocrates has said, That swellings in the joints, and pains unattended with an ulcer, are eased and lessened by having a large quantity of cold water poured upon them^c. And since his time several eminent physicians have recommended the same method. And possibly at the first coming on of the disease it might be of service, by contracting the parts with a sudden coldness, and so repelling the humour, which begins to be accumulated, whilst it is yet thin. But if it be already grown thick, and the quantity be considerable, very little benefit can seemingly be expected from it. Frequently repeated frictions, the motion of the joint affected, very penetrating fomentations of wine, salt, vinegar, and the urine of a sound person, with an addition of the aromatic herbs, such as horehound, scordium, rue, &c. and cataplasms made of the like ingredients, will be more beneficial. In very difficult cases also embrocations of warm mineral waters falling gently down from on high upon the part affected, have given considerable ease, and sometimes wrought a perfect cure. And the want of these mineral waters may be supplied by the above-mentioned very penetrating fomentations applied in the same manner. M. Petit^d says, he saw very surprising effects from a like demission of lime-water mixed with a lixivium of sal-ammoniac upon the place affected; for thus you have a very penetrating spirit of sal-ammoniac formed in a moment, which is deservedly allowed to be a most attenuating remedy. But where the quantity of matter accumulated is so great, that it cannot be dispersed by all these

^c Aphor. 25. sect. v. Charter. Tom. IX. p. 210.

^d Traite des Maladies des Os, Tom. I. p. 406.

these applications, this gentleman advises to lay open the tumour by incision, till you come to the hollow part of the joint, in the place which bends most downwards, that the liquid contained within may the more easily run off; and when this is done, he directs the application of the above-mentioned remedies.

[The stiffness of the ligaments.] That the articulated bones may perform their motion in due manner, it is necessary that the ligaments which fasten the joint should have such a degree of firmness, as to be able to retain the bones in their proper situation; and yet be so pliable, as to allow the joint to bend. When therefore the ligaments are by any means grown absolutely stiff, though in every other particular the joint should be in a natural state, all power of motion will be taken away; and this will be afterwards followed by a tumour, from an accumulation of the liniment of Havers within the cavity of the joint, and its not being carried off by motion, as is usual in health; and thus there will be formed a perfect ancylosis. The causes of this disorder may be all those which give too great a stiffness to the fibres, (see §. 32); as also those which produce a like effect in the lesser and greater vessels of the body, (see §. 51.) Thus we see very old men grow stiff in almost every joint, partly indeed from a defect of the oleaginous liquid, which lubricates the joints, and partly from the ligaments growing callous, and even sometimes bony; which disorders in men, who get their livelihood by hard labour, are frequently found to come on before they grow old, the solid parts of the body being indurated by the too violent exercise of the muscles, (see §. 51, n^o 3.) The same disorder is apt to follow after great inflammations of the ligaments that have not been well taken care of, the stagnating and coagulated liquid concreting with the vessels wherein it is contained, (see §. 51, n^o 4.) whence gouty persons are so often subject to an immobility of the joints. Besides, we shewed under §. 25. n^o 3. that too great a distension of the solid parts of the body renders them too weak, and that the weakness produced from this cause is cured by any means that

will remove the too great distension, (see §. 28, n^o 5.) When therefore the ligaments, for want of motion in the joint, are not stretched out, they will spontaneously contract, and become so rigid as afterwards to obstruct all motion in the joint. After the cure of fractures or luxations, an ancylosis frequently arises from this cause, if care be not taken during the cure sometimes to move the joints, and so also in paralytic limbs; and as the muscles, which are benders, are generally stronger than the extensors, the joints which in this case grow stiff are almost constantly a little bending, not only from the induration of the ligaments, but also as the muscoli flexores are by long disuse gradually contracted and made shorter, and seldom admit of their being lengthened again ever after.

It is evident therefore, that the too great stiffness of the ligaments is of all others the most frequent cause of an ancylosis; but withal, that there is great reason to hope for a cure, unless the disease be of very long standing, or owe its original to such causes as are not to be overcome by art, such, for instance, as occur in extreme old age. If the patient be put upon an emollient diet; and the part affected be frequently every day exposed to watery bathings, and especially to the vapour-bath; and then, after it is well wiped, be thoroughly rubbed with very smooth oils; and after this an attempt be made to move the joint by bending and extending the limb, so far as it can be done without pain; a cure shall sometimes be wrought in a case which might seem to be desperate. But these particulars have been spoke to more at large in §. 30, 31, 51. I shall here only produce a single instance in confirmation of what has been advanced^e. The right leg of a young person, upon his recovery from an acute fever attended with a coma, was so bent inwards, that he could by no means extend it; at the same time he had such intolerable pains about the joint of the knee, as almost took away the entire use of the limb, since he neither could walk with a wooden leg, nor go upon crutches, the violence of his pain encreasing by the weight

^e Acad. des Sciences, l'an 1721. Mem. p. 283, &c.

weight of the pendulous leg dragging upon the joint. After he had continued better than a year in this condition, the surgeons consulted were of opinion, that the os femoris and the tibia were consolidated; and as a great many remedies had been long applied without any relief, they concluded that nothing would do but amputation; which the poor creature, tired out with his sufferings, very readily submitted to. An experienced physician, however, called in at this time to prepare him by proper medicines for undergoing this hazardous operation, upon carefully examining the part, found that neither the internal condylus of the os femoris, nor the corresponding part of the tibia, were much increased in bulk, nor were these places painful when pressed by his fingers, but the chief pain he felt was in that place where the ligament lies that ties the patella to the tibia. When the doctor farther endeavoured to extend the bended leg with all the force he could, he perceived that the bones were not grown together, though the slightest extension could not be made without excessive pain; at the same time the tendons of the musculi flexores appeared to be extremely tense, and somewhat drawn back towards their origin. Upon full consideration of all particulars, he advised against the amputation; and, after the administration of some general remedies, attempted the cure by warm-bathing, which he directed to be used for an hour or an hour and a half twice every day. The bath was prepared of warm water, with an addition of some aromatic ingredients; and the body of the patient was entirely immersed in it. This method succeeded so well, that the poor man had not been four times in the bath, before his leg began to be extended; and after bathing eight times, he could put it to the ground, and walk with crutches. At last, by repeated bathings, and the outward application of an oily liniment, he was perfectly cured; only the abovementioned swelling of the bones remained, though without any impediment to the motion of the joint, except that if at any time he walked too far he felt a slight pain in that leg. We have a like method of cure for an anchylosis

recommended by Ægineta †: for he advises the part affected to be washed over with a mixture of oil and water, wherein linseed, marsh-mallows, fœnugreek, &c. had been boiled; and then to be anointed with liniments consisting partly of emollient and partly of aromatic ingredients, and covered with a resembling plaster; at the same time he directs the use of gentle and continued friction, and orders the patient to try frequently whether the limb could not be bent and extended at the joint.

An exostosis near the joints.] As the motion of the joint requires a particular shape in the extremities of the articulated bones, it is very plain, that if this shape be altered by an exostosis, it must be an impediment to the motion. When we before treated of an exostosis, we shewed, that such tumours were sometimes found to rise near the joints. To this head, I think, we may refer the concretion of the articulated bones, whether they are united by the interposition of the inspissated liniment which naturally belongs to the joints, or whether the rough and eroded surfaces of contiguous bones are accidentally consolidated to each other. Of this kind we have several very extraordinary cases recorded by physical writers. Thus Hildanus tells us, that he kept amongst his curiosities certain bones, which he had picked up out of a burying ground ‡, wherein there was a surprising concretion of the articulated bones; and in his figures he has given us a delineation of the bones of the ulna entirely concreted with the os humeri, and an os femoris so united to the acetabulum of the os ischii as if it had always been only one continued bone. In a child of two and twenty months old the whole body seemed to consist but of one continued bone, so that none of the joints could be bent any way whatsoever ^h. Columbus, in the head of a very large man, found the lower jaw so joined to the skull, that when he was alive it must have wanted all motion; the first vertebra also was so united to the back part of the head, that it could never

† Lib. iv. cap. 55. p. 70 and 71.
cap. 25. p. 882.

‡ De Ichore et Meliceria,
Acad. des Sciences, l'an 1716. Hist. p. 30.

ver have moved ⁱ. But the following case, related by the same author, is of all others the most astonishing. There long lived at Rome, in the hospital of the incurables, a man who had all his joints stiff, and could move nothing but his eyes, his tongue, his penis, the abdomen, and the thorax. During his life-time, being then old, he was frequently visited by the famous physician Joannes Auricula, who after his death made Columbus a present of his skeleton, in which every joint of the whole body from the head to the toes was found to be concreted; two of his upper teeth were wanting, as also the two opposite ones in the lower jaw; and through this aperture his meat and drink were given him, whilst he lived.

What we have already said is sufficient to shew, that the cure of an ankylosis is always difficult; however, the judgment concerning it is different according to the diversity of the cause from whence it is known to proceed. For if it arises from the callus of a bone broken near the joint, and has already acquired the hardness of bone, it is then incurable; as also if it proceeds from an exostosis or concretion of the articulated bones. But if it owes its original to an inspissation of the liniment of Navers, or the stiffness of the ligaments; unless the case be of very long standing, there is reason to hope that it may be cured.

§. 557. **W**HETHER therefore has so thoroughly understood the diseases already described, and which are subject to the sight, as to be well acquainted with their several causes, nature, effects, and method of cure; and has applied all these particulars to the internal and unseen parts of the body; and compared them with the actions of the sound parts, and afterwards with the several appearances of internal diseases; will find, that what is internal corresponds exactly with what is external; that external diseases, which

which fall under the surgeon's care, ought first to be treated of; and that otherwise nothing regular or just could be performed or advanced in the practice of physic.

Having thus treated of the diseases appertaining to surgery, it may not be amiss, before we come to give an account of internal diseases, and the method of cure required in them, to point out, in a few words, how great an insight the knowledge of external diseases will afford us in the discovery and cure of such as are internal; and at the same time we shall give a very plain reason, why external diseases ought first to be treated of.

In the introduction, (§. 16.) the rules were laid down for fixing the properest order in which diseases ought to be discoursed of; namely, to begin with such diseases as were most thoroughly known, and most easily cured, which in their nature were most simple, and were necessary to be known in order to understand others. Now as the diseases seated in the external parts of the body are exposed to the senses, and consequently can be more distinctly known, and more easily admit the application of remedies to the part affected; as, likewise, diseases resembling these occur in the internal parts, whose several appearances and successive alterations are not so obvious to the senses; it is plain, that an account of external diseases ought first to be premised. And how great the resemblance is between external and internal diseases, it may not be improper to shew from one single instance.

If a true phlegmon seizes the finger, a red tumour, not yielding to pressure, attended with a pricking pain and heat, will be seen in the part affected; and if the inflammation be in any respect considerable, it will be accompanied with a fever: and from these symptoms it is we conclude, that there is an inflammation. If now a person in perfect health, who has heated himself by violent motion, shall expose his naked breast to the cold blasts of the north-wind, there will frequently arise on a sudden a very sharp pain in the parts that
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lie between the ribs, which shall increase exceedingly every time he draws in his breath, and be also attended with a pretty violent fever. The question now is, What is the nature of this disease, and what method of cure is proper to be used in it? In this case we know that the same causes have preceded, which do frequently produce a true phlegmon. For we have shewn in §. 117, that the particles of our fluids are apt to run together and unite by heat and violent circulation; and, in §. 118, we shewed, that from an increase of motion the thicker fluids might by error of place enter into the dilated orifices of conical canals, without being able to pass through their extremities; and at the same time it was observed, that obstructions of the worst kind were produced, if a sudden cold succeeding to a violent heat constricted the dilated vessels, that were already crowded with foreign humours which had gained admission into them by error of place: from all which it appears very evidently, that we have here concurring the principal causes of an obstruction. But it farther has appeared from §. 374, that the causes of an obstruction are sufficient to produce a true phlegmon; and from what has been said in §. 373, 374, it is certain, that an inflammation may have its situation in almost every part of the body, and that it is most frequently seated in the fat. As therefore the causes of an inflammation have preceded, and the place affected is a place properly disposed for receiving an inflammation, we have reason to conclude, that the sharp pain, which increases upon every the least drawing of the breath, and is attended with a fever, is a true inflammation of the intercostal parts. The swelling and redness indeed, which in the inflamed finger were visible to the senses, are not always to be seen in this case, because the phlegmon lies too deep to be discerned: but the pricking pain, as if the breast was run thro' with a sword, when the thorax is dilated by inspiration, and the attending fever, are sufficient to evince the nature of the disorder; for the inflamed finger also, if it be moved, or roughly handled, shall be exceeding painful. If now we consider

sider the nature and action of the part affected, we shall evidently see that all the disorders following upon an inflammation in the intercostal parts are capable of being understood from the symptoms which shew themselves to the senses in the inflammation of an external part. For there will arise here also a swelling from the distension of the inflamed arteries, which will be very much increased by the very small vessels and vesicles of the panniculus adiposus, (which in animals that are fat is so very conspicuous between the ribs), being crowded with thick blood, which has lost its thinner part, (see §. 382.): from the distension of the nervous fibres dispersed through the membranes of the distended vessels, will follow pain; which will here be extremely severe, if the tumour protuberating to the inner parts drag slowly the membrane termed the *pleura* from the ribs, to which it adheres; and as the breast is dilated by inspiration, and the ribs recede from each other, the reason is very evident, why the pain is so much increased by drawing in the breath. To avoid this intolerable pain, or mitigate it at least, the diseased are apt scarce to inspire at all, or at least to draw in the smallest quantity of air they can, by which means the lungs are not sufficiently dilated; and thus there is an obstruction formed in the right ventricle of the heart, great anxiety follows, the lungs are stuffed with blood, and a peripneumony arising from the pleurisy frequently carries them off in a very short time.

Besides, the same events all together follow in this case, as in other inflammations of the external parts of the body, namely, resolution, suppuration, or a gangrene. For that a mild pleurisy may be cured by resolution; that a severer terminates in an abscess; and the severest in a gangrene, a livid spot frequently appearing suddenly in the place affected, and the pain entirely ceasing without any correction of the cause; is what we learn by most certain and common experience, as shall be afterwards shewn more at large when we come to treat of a Pleurisy. The same method of cure also takes place in a pleurisy, as in other inflam-

inflammations. For a resolution is here always attempted by bleeding, by diluting and attenuating medicines, by fomentations, cataplasms, and plasters, &c. applied to the place affected, and in general by all the applications recommended in the cure of an inflammation from §. 395. to §. 402. But when a resolution cannot be obtained, a gentle suppuration is promoted by the several methods laid down in §. 402, *et seq.* particularly by endeavouring as much as possible to make the abscess point externally, as there is so much cause to apprehend, that if it break inwardly, a fatal empyema may ensue, and the purulent matter be discharged into the cavity of the breast. But where a gangrene follows after a pleurisy, which is almost constantly mortal, the only hope left of cure is from the remedies advised in §. 434. *et seq.* as will plainly appear upon comparing what we have here said with what we shall hereafter advance in §. 903. concerning the cure of a gangrenous Pleurisy.

The same may be also proved of an inflammatory angina, a phrenitis, a peripneumony, and other inflammatory diseases of the internal parts, the only difference of these diseases depending upon the different function of the parts affected. In all other particulars they entirely agree. And therefore we may justly lay it down as an axiom, That internal diseases exactly correspond with such as are external; and that nothing regular or just can be either performed or advanced in the practice of physic, unless the external diseases appertaining to surgery be first accounted for, before we come to treat of such diseases as are internal.

